

# EV Motor Materials Monthly Report

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## Global Passenger EV Sales Down 34% Month-over-Month But Still Up 22% Year-over-Year in April 2022 Despite Multitude of Supply Chain Disruptions

In April 2022, total passenger EV sales in the Asia Pacific region amounted to 442,845, a 39.0% drop month-over-month due to seasonality and COVID lockdowns in China but a 39.9% increase over the same month the year prior following.

In Europe, total passenger EV sales amounted to 246,138 in April 2022, a 32.9% drop month-over-month and a mere 1.0% increase year-over-year.

Similarly, in the Americas, total passenger EV sales amounted to 151,628 in April 2022, a 17.4% drop month-over-month but a 17.7% increase over the same month the year prior.

## 38% More Motor Power Deployed Onto Roads Globally in April 2022 than April 2021

In April 2022, total global motor power deployed onto roads in all newly-sold passenger EVs combined amounted to a 100,922 MW, 37.8% more than the same month the year prior (but a 40.1% drop month-over-month) led by strong BEV and PHEV sales growth year-over-year.

By motor type, permanent magnet synchronous motors (“PMSMs”) were responsible for 91% of all motor power deployed onto roads globally in April 2022, and by EV maker, BYD, Toyota and Tesla were collectively responsible for 41% of all EV motor power deployed globally, respectively.

The sales-weighted average (“SWA”) motor power of all passenger xEVs (HEVs, PHEVs and BEVs) sold globally in April 2022 was 119.6 kW, up 13.0% from 105.9 kW in April 2021.

## 100.9 GW of Passenger EV Traction Motor Power Deployed Globally in April 2022

Region	Country	Motor Type	Motor Make	EV Make	EV Model	EV Type
Full graphs visible to subscribers						



# Motor Power Deployed by Region

## Asia Pacific Holds the Lead, Motor Power Deployment Up 51% Year-over-Year in April 2022

In April 2022, a total of 49.5 GW of passenger EV traction motor power was deployed onto roads in the Asia Pacific region (80% in China alone), a 51.1% increase over April 2021 despite the most recent COVID lockdowns in China.

In China, passenger EV sales totaled 321,849 in April 2022, a 48.3% increase over April 2021 but a 39.5% drop month-over-month.

## The Americas Move Up to Second Spot, Motor Power Deployment Up 46% Year-over-Year in April 2022

In the Americas, a total of 26.6 GW of passenger EV traction motor power was deployed onto roads in April 2022 (93% in the U.S. alone), a 45.6% increase over April 2021, albeit a 24.4% drop month-over-month.

In April 2022, passenger EV sales in the Americas totaled 151,628, up 17.7% over April 2021 but down 17.4% month-over-month.

## Share of Motor Power Deployed by Country



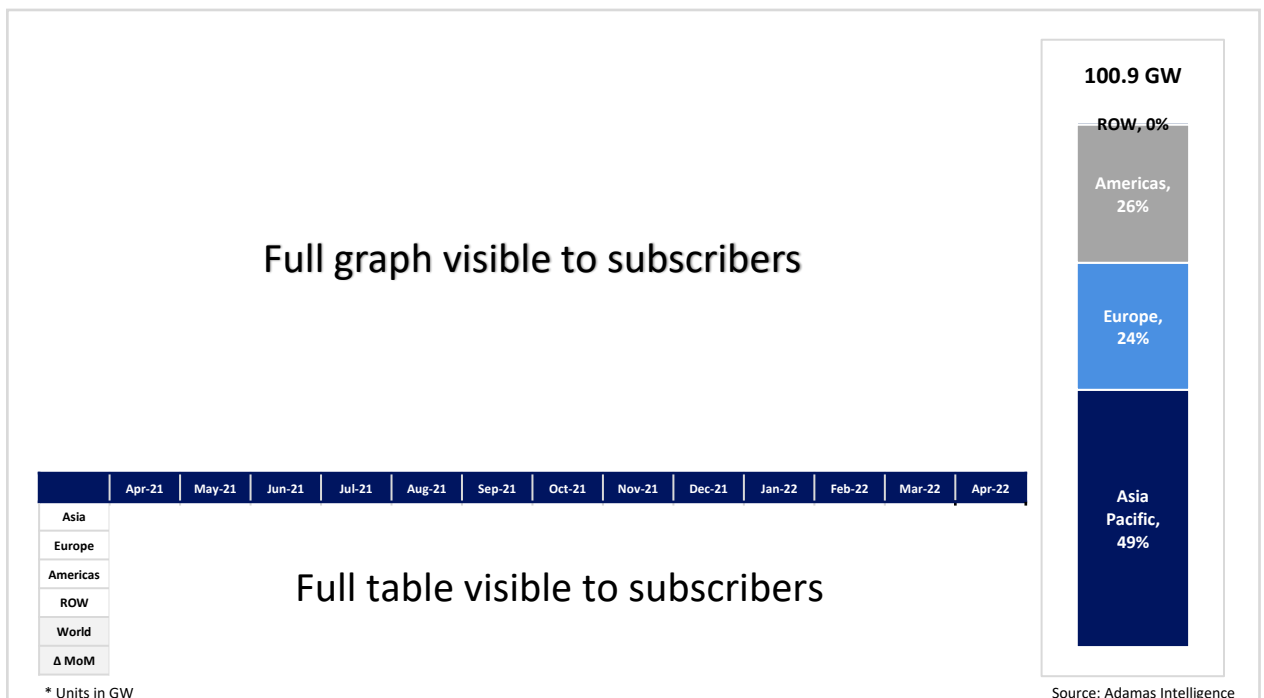
Source: Adamas Intelligence data

## Europe Falls to Third Place, Motor Power Deployment Up Just 11% Year-over-Year in April 2022

In Europe, a total of 24.4 GW of passenger EV traction motor power was deployed onto roads in April 2022, a mere 10.9% increase over April 2021 and a 45.5% drop month-over-month.

In Europe, passenger EV sales amounted to 246,138 in April 2022, a 1.0% gain over April 2021 but a 32.9% drop month-over-month as some of the region's major EV makers, including Tesla and VW Group, faced supply chain disruptions and COVID induced lockdowns.

## Passenger EV Traction Motor Power Deployment by Region in April 2022



Source: Adamas Intelligence



# Motor Power Deployed by Automaker

## BYD in the Lead, 294% More Motor Power Deployed in April 2022 than Same Month Year Prior

In April 2022, BYD deployed 15.9 GW of passenger EV traction motor power onto roads globally, up 294.1% over the same month the year prior as the automaker's monthly EV sales leapt 317.3% in parallel.

In total, BYD sold 105,787 passenger EVs (55% BEVs, 45% PHEVs) globally in April 2022 with a sales-weighted-average motor/generator power of 150.4 kW per EV, down 5.5% from 159.3 kW in April 2021.

## Toyota Held Onto Second, Motor Power Deployment Up Just 1% Year-over-Year in April 2022

In April 2022, Toyota deployed 13.1 GW of passenger EV traction motor power onto roads globally, a mere 1.0% increase over the same month the year prior as global sales of the automaker's EVs fell by 0.4% over the same period.

In total, Toyota sold 145,627 passenger EVs (96% HEVs) globally in April 2022 with a sales-weighted-average motor/generator power of 89.9 kW per EV, up 1.4% from 88.7 kW in April 2021.

## Tesla Dropped to Third Spot as its Shanghai Factory Closed for 22 Days

In April 2022, Tesla deployed 12.2 GW of passenger EV traction motor power onto roads globally, up 34.3% over the same month the year prior but down 75.4% month-over-month due to a prolonged pandemic-induced closure at its Shanghai factory.

In total, Tesla sold 39,218 passenger EVs (all BEVs) globally in April 2022 with a sales-weighted-average motor power of 311.4 kW per EV, up 9.6% from 284.2 kW in April 2021.

## Kia Claimed a Distant Fourth Place, 138% Increase in Deployment Year-over-Year

In April 2022, Kia deployed 3.5 GW of passenger EV traction motor power onto roads globally, up 137.6% over the same month the year prior as the automaker's monthly EV sales increased 75.2% over the same period.

In total, Kia sold 43,394 passenger EVs (36% BEV, 15% PHEV and 50% HEVs) in April 2022 with a sales-weighted-average motor/generator power of 80.0 kW per EV, up 35.6% from 59.0 kW in April 2021.

## Passenger EV Traction Motor Power Deployed by Automaker in April 2022 (Top 10)

Full graph visible to subscribers



# Motor Power Deployed by Motor Supplier

## BYD Grabs the Top Spot, Monthly Motor Power Deployment Jumped 282% Year-over-Year

In April 2022, BYD deployed 15.9 GW of passenger EV traction motor power onto roads globally (in BYD, Denza, Liten and Yema EVs), up 282.1% over the same month the year prior as sales of BYD-branded EVs in particular surged year-over-year.

Overall, the sales-weighted average EV equipped with a BYD motor/generator in April 2022 had a peak power of 150.4 kW, down 6.6% from 161.1 kW in April 2021.

## Toyota Group Companies In Second, Motor Power Deployment Up Just 2% Year-over-Year

As supplier to Toyota, Lexus and a handful of other Toyota Motor Company brands, Toyota Group Companies (including Denso and Aisin Seiki) deployed 15.3 GW of traction motor/generator power globally in April 2022, up just 2.0% over the same month the year prior as the family's monthly EV sales and average EV's motor/generator power declined by 1.8%.

Overall, the sales-weighted average EV equipped with a Toyota Group Companies motor/generator in April 2022 had a peak power of 92.4 kW, up 3.9% from 89.0 kW in April 2021.

## Tesla's Motor Power Deployment Down 75% Month-over-Month Due to Prolonged Pandemic-Related Shanghai Shutdown

In April 2022, Tesla deployed 12.2 GW of passenger EV traction motor power onto roads globally in its own EVs, down 75.4% month-over-month but up 34.3% over the same month the year prior.

In total, PMSMs were responsible for an estimated 77.8% of all motor power deployed by Tesla in April 2022, up from 69.4% the same month a year ago.

## Hyundai Mobis Held Onto Fourth Place, Motor Power Deployment Up 136% Year-over-Year

In April 2022, Hyundai Mobis deployed 7.1 GW of passenger EV traction motor/generator power onto roads globally, up 136.0% over the same month the year prior but down 10.4% month-over-month.

Overall, the sales-weighted average EV equipped with a Hyundai Mobis motor/generator in April 2022 had a peak power of 88.5 kW, up 51.9% from 58.3 kW in April 2021.

### Passenger EV Traction Motor Power Deployed by Motor Supplier in April 2022 (Top 10)

Full graph visible to subscribers



# Motor Power Deployed by Motor Type

## 39% More Permanent Magnet Motor Power Deployed Onto Roads in April 2022 than April 2021

In April 2022, 91.6 GW of permanent magnet synchronous motor (“PMSM”) power was deployed onto roads globally in all newly-sold passenger EVs combined, an increase of 39.5% over the same month the year prior.

Over the same period, the global sales-weighted-average peak power of all passenger EV traction PMSMs combined increased by 13.8%, from 98.0 kW per EV in April 2021 to 111.5 kW in April 2022.

## 8% More Induction Motor Power Deployed Onto Roads in April 2022 than April 2021

In April 2022, 6.9 GW of induction motor power was deployed onto roads globally in all newly-sold passenger EVs combined, a 7.8% increase over the same month the year prior.

Over the same period, the global sales-weighted-average peak power of all passenger EV induction motors combined fell 13.6% year-over-year, from 148.9 kW per EV in April 2021 to 128.7 kW in April 2022.

## Sales-Weighted Average Motor Power by Region



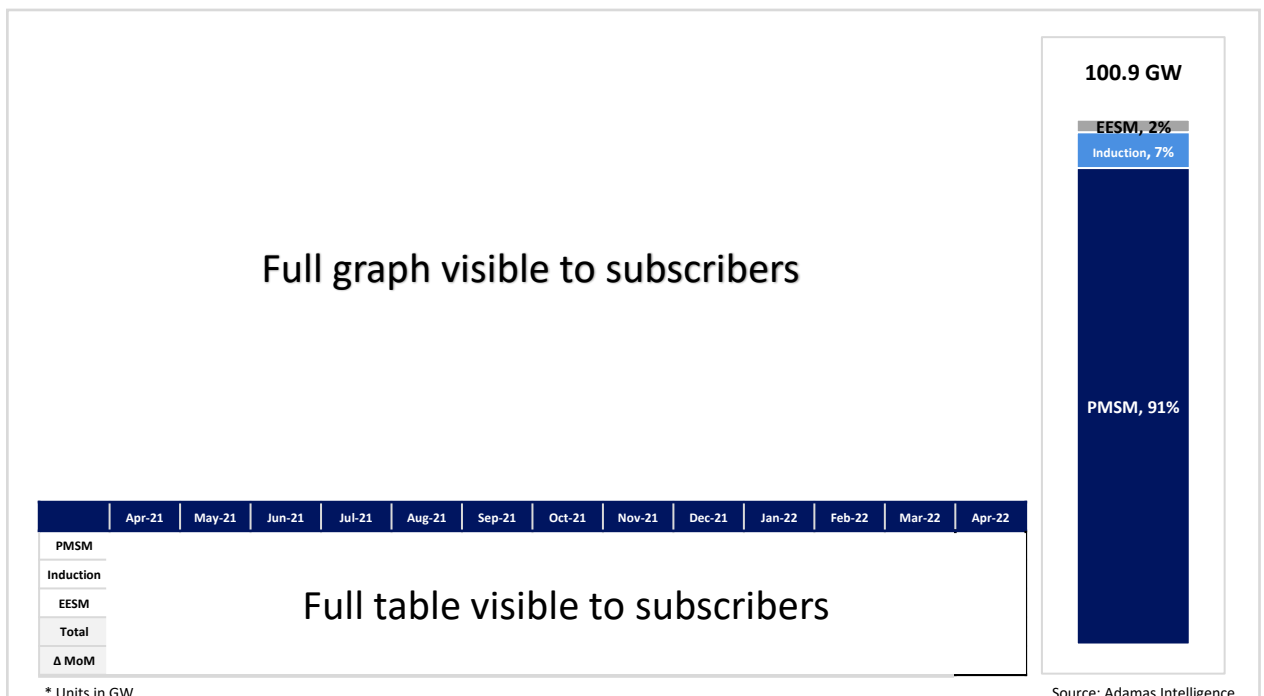
Source: Adamas Intelligence data

## 108% More Electrically-Excited Synchronous Motor Power Deployed in April 2022 than April 2021

In April 2022, 2.4 GW of electrically-excited synchronous motor (“EESM”) power was deployed onto roads globally in all newly-sold passenger EVs combined, an increase of 107.6% over the same month the year prior on the back of Renault and BMW sales.

Over the same period, the global sales-weighted-average peak power of all passenger EV traction EESMs combined increased 85.5%, from 92.8 kW per EV in April 2021 to 172.2 kW per EV in April 2022 on the back of strong BMW EV sales growth.

## Passenger EV Traction Motor Power Deployed by Motor Type in April 2022



Source: Adamas Intelligence

# NdFeB Magnet Deployment Overview

## Quick Facts

### In April 2022:

- **97%** of all passenger xEVs sold globally contained one or more traction PMSMs
- **91%** of all passenger xEV traction motor power (kW) deployed onto roads globally was from PMSMs
- The global sales-weighted average PMSM peak motor power was **111.5 kW**
- The sales-weighted average PMSM contained an estimated **X.XX kilograms** of NdFeB magnets
- China EV sales responsible for **XX%** of all NdFeB magnet deployment; the U.S. **XX%**, Europe **XX%**
- BYD alone was responsible for **XX%** of global NdFeB magnet deployment; Toyota **XX%**; Tesla **XX%**

## Global Monthly Passenger EV Motor Power Deployment Up 38% Year-over-Year Translating to an 39% Increase in NdFeB Magnet Consumption

In April 2022, 37.8% more passenger EV motor power was deployed onto roads globally than the same month the year prior translating to an 39.5% increase in NdFeB magnet use in passenger EV traction motors and generators over the same period.

In April 2022, a total of 1,099 tonnes of NdFeB magnets were deployed onto roads globally in the traction motors and generators of newly-sold passenger EVs, an 39.5% increase over April 2021 on the back of strong year-over-year BEV and PHEV sales growth, particularly in Asia Pacific.

## Monthly Magnet Deployment Way Up in Asia Pacific and Americas, Modestly Up in Europe Year-over-Year

In April 2022, 565 tonnes of NdFeB magnets were deployed onto roads in the traction motors and generators of newly-sold passenger EVs in the Asia Pacific region, a 58.2% increase over the same month the year prior on the back of strong monthly EV (particularly BEV and PHEV) sales growth year-over-year, especially in China.

Similarly, in April 2022, 278 tonnes of NdFeB magnets were deployed onto roads in the traction motors and generators of newly-sold passenger EVs in the Americas, a 42.2% increase over April 2021 on the back of a moderate increase in EV sales over the same period.

Moreover, in April 2022, 252 tonnes of NdFeB magnets were deployed onto roads in the traction motors and generators of newly-sold passenger EVs in Europe, an increase of just 8.1% over the same month the year prior due to sluggish EV sales growth over the same period.

## 1,099 Tonnes of NdFeB Magnets Deployed Globally in Passenger EV Traction Motors in April 2022

Region	Country	Motor Type	Motor Make	EV Make	EV Model	EV Type
Full graphs visible to subscribers						



# NdFeB Magnets Deployed by Region

## Asia Pacific in the Lead with a 51% Share of Global NdFeB Magnet Deployment in April 2022

In April 2022, 565 tonnes of NdFeB magnets were deployed onto roads in the traction motors/generators of newly-sold passenger EVs in Asia Pacific, a hefty 58.2% increase over the same month the year prior.

In April 2022, Asia Pacific's share of global monthly NdFeB deployment amounted to 51%, down from 55% the month prior but up from 45% the same month the year prior.

## NdFeB Magnet Deployment Up 42% Year-over-Year in the Americas, Responsible for 25% of Global Deployment, Same as a Year Ago

In April 2022, 278 tonnes of NdFeB magnets were deployed onto roads in the traction motors/generators of newly-sold passenger EVs in the Americas, a 42.2% increase over the same month the year prior but a 21.6% drop month-over-month.

In April 2022, the Americas' share of global monthly NdFeB magnet deployment amounted to 25%, unchanged from the same month the year prior.

## Share of NdFeB Magnets Deployed by Country



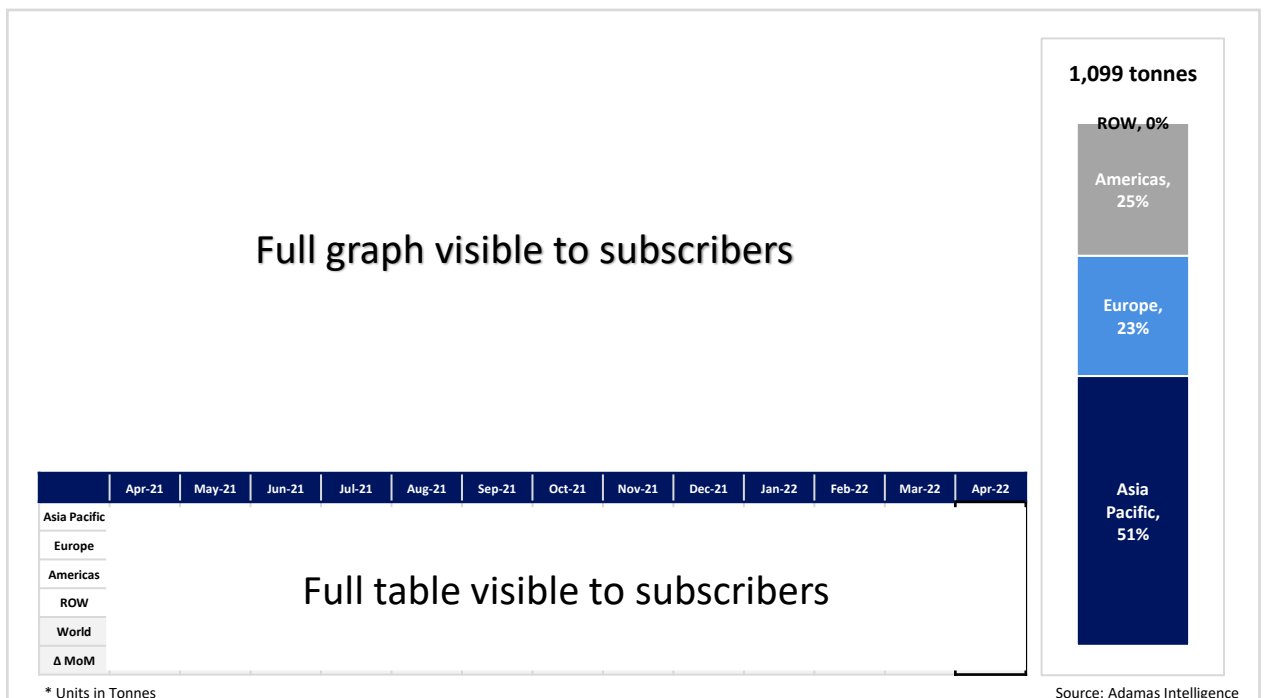
Source: Adamas Intelligence data

## Europe's NdFeB Magnet Deployment Up 8% Year-over-Year, Market Share Drops from 30% to 23%

In April 2022, 252 tonnes of NdFeB magnets were deployed onto roads in the traction motors/generators of newly-sold passenger EVs in Europe, an 8.1% increase year-over-year but a 42.3% drop month-over-month.

In April 2022, Europe's share of global monthly NdFeB deployment amounted to 23%, down from 32% the same month the year prior as the Asia Pacific market, and specifically that of China, sped further ahead.

## NdFeB Magnet Deployment in Passenger EV Traction Motors by Region in April 2022





# NdFeB Magnets Deployed by Automaker

## BYD In the Lead, Monthly Magnet Deployment Up a Massive 294% Year-over-Year

In April 2022, BYD deployed 191 tonnes of NdFeB magnets onto roads globally in the traction motors/generators of its newly-sold passenger EVs globally, up 1.6% month-over-month and a massive 294.1% year-over-year.

In total, BYD sold 105,787 passenger EVs (55% BEVs, 45% PHEVs) globally in April 2022 with an estimated sales-weighted-average NdFeB consumption of 1.8 kg per EV (considering traction motor(s) and generator(s) only), down 5.5% from April 2021.

## Toyota in Second, NdFeB Magnet Deployment Down 1% Year-over-Year

In April 2022, Toyota deployed 157 tonnes of NdFeB magnets onto roads in the traction motors/generators of its newly-sold passenger EVs globally, down 27.2% month-over-month and 0.9% versus the same month the year prior.

In total, Toyota sold 145,627 passenger EVs (96% HEVs) globally in April 2022 with an estimated sales-weighted-average NdFeB consumption of 1.1 kg each (considering traction motor(s) and generator(s) only).

## Tesla in Third, Magnet Deployment Down 76% Month-over-Month

In April 2022, Tesla deployed 114 tonnes of NdFeB magnets onto roads in the traction motors of newly-delivered passenger EVs globally, down 75.8% month-over-month but up 50.6% over the same month the year prior.

In total, Tesla delivered 39,218 passenger EVs globally in April 2022 with an estimated sales-weighted-average NdFeB consumption of 2.9 kg per EV, up 22.9% from April 2021.

## Kia Seized Fourth Place, NdFeB Magnet Deployment Up 138% Year-over-Year

In April 2022, Kia deployed 42 tonnes of NdFeB magnets onto roads in the traction motors/generators of its newly-sold passenger EVs globally, down 10.5% month-over-month but up 137.6% year-over-year.

In fifth spot, Volvo deployed 40 tonnes of NdFeB magnets onto roads globally in traction motors/generators in April 2022, down 10.3% month-over-month but up 77.1% year-over-year.

## NdFeB Magnet Deployment in Passenger EV Traction Motors by Automaker in April 2022 (Top 10)

Full graph visible to subscribers





# NdFeB Magnets Deployed by Motor Maker

## BYD Claimed First, Deployed 282% More NdFeB in April 2022 than Same Month a Year Ago

In April 2022, BYD deployed 191 tonnes of NdFeB magnets onto roads in newly-sold passenger EV motors/generators globally, up 282.1% over April 2021 and 1.1% month-over-month.

Overall, the global sales-weighted average EV deployed with a BYD motor/generator in April 2022 contained an estimated 1.8 kg of NdFeB, down 6.6% from April 2021 on the back of a similar decline in BYD's sales-weighted-average motor/generator power over the same period.

## Toyota Group Companies Held Onto Second, Just 2% Increase in NdFeB Magnet Deployment Year-over-Year

Toyota Group Companies (including Denso and Aisin Seiki) collectively deployed an estimated 183 tonnes of NdFeB magnets onto roads globally in newly-sold passenger EV traction motors/generators in April 2022, up 2.0% over April 2021 but down 27.9% month-over-month.

Overall, the global sales-weighted average EV equipped with a Toyota Group Companies motor/generator in April 2022 contained an estimated 1.1 kg of NdFeB magnets, up 3.8% over April 2021.

## Tesla Fell to Third Spot, 76% Drop in NdFeB Magnet Deployment Month-over-Month

As motor supplier to itself, Tesla deployed an estimated 114 tonnes of NdFeB magnets onto roads globally in the PMSM traction motors of its newly-delivered EVs in April 2022, down 75.8% month-over-month but up 50.6% over the same month the year prior.

In total, the Tesla Model Y and 3 were responsible for 38% and 31% of Tesla's NdFeB deployment in April 2022, respectively, and the Model S and X were collectively responsible for the remaining 31%.

## Hyundai Mobis Remained in Fourth, 136% Increase in NdFeB Magnet Deployment Year-over-Year

In April 2022, Mobis deployed 85 tonnes of NdFeB magnets onto roads in newly-sold passenger EV traction motors/generators globally, up 136.0% year-over-year but down 10.4% month-over-month.

Overall, the global sales-weighted average EV deployed with a Mobis motor/generator in April 2022 contained an estimated 1.1 kg of NdFeB magnets, up 51.9% over the same month the year prior.

## NdFeB Magnet Deployment in Passenger EV Traction Motors by Motor Supplier in April 2022 (Top 10)

Full graph visible to subscribers



# NdFeB Magnets Deployed by EV Type

## BEVs Responsible for 55% of Global NdFeB Magnet Deployment in April 2022, Magnet Demand for BEVs Up 69% Year-over-Year

In April 2022, 600 tonnes of NdFeB magnets were deployed onto roads globally in the traction motors and generators of newly-sold battery electric vehicles (“BEVs”), an increase of 68.9% over the same month the year prior.

In total, BEVs were responsible for 55% of all NdFeB deployed globally in passenger EV traction motors/generators in April 2022, up from 45% in April 2021.

## PHEVs Responsible for 22% of Global NdFeB Magnet Deployment in April 2022, Magnet Demand for PHEVs Up 41% Year-over-Year

In April 2022, 243 tonnes of NdFeB magnets were deployed onto roads globally in the traction motors and generators of newly-sold plug-in hybrid electric vehicles (“PHEVs”), a 41.2% increase over the same month the year prior.

In April 2022, PHEVs were responsible for 22% of all NdFeB deployed globally in passenger EV traction motors and generators, unchanged from April 2021.

## Sales Weighted Average NdFeB Use per EV Type



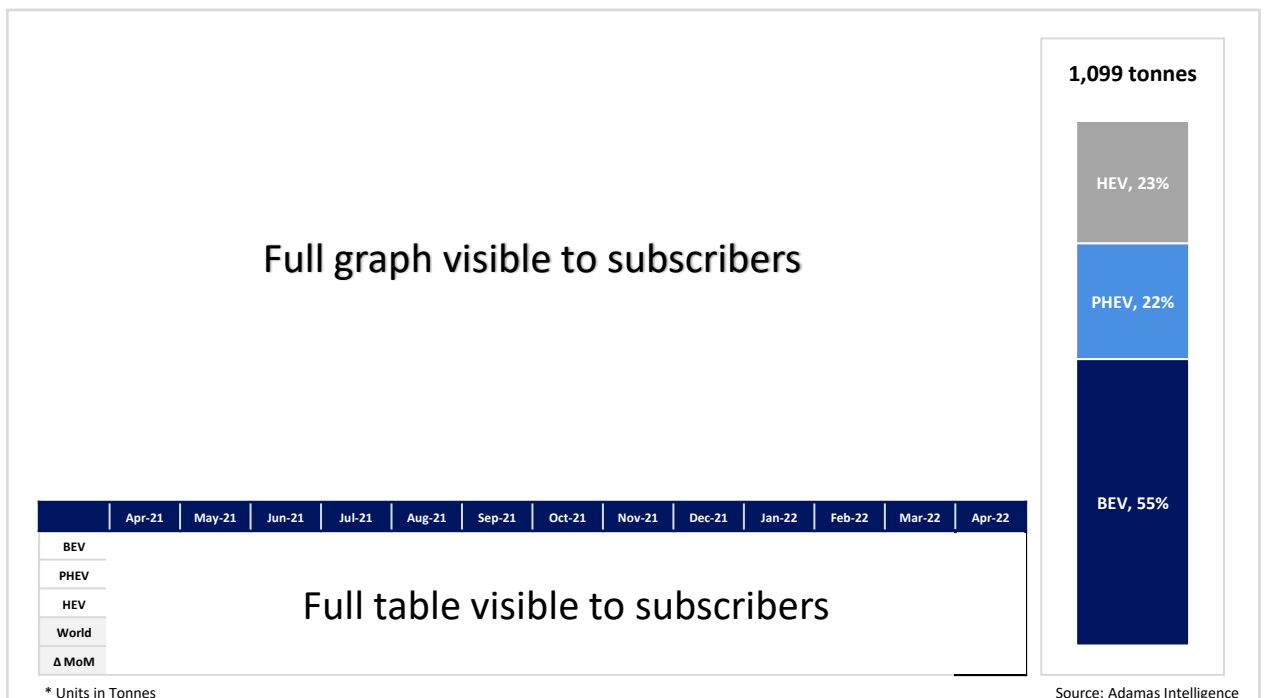
Source: Adamas Intelligence data

## HEVs Responsible for 23% of NdFeB Deployed, Magnet Demand for HEVs Down 2% Year-over-Year

In April 2022, 256 tonnes of NdFeB magnets were deployed onto roads globally in the traction motors and generators of hybrid electric vehicles (“HEVs”), a 1.7% drop versus the same month the year prior.

In total, HEVs were responsible for 23% of all NdFeB deployed globally in passenger EV traction motors/generators in April 2022, down from 33% in April 2021 as HEV sales growth continues to underperform that of BEVs and PHEVs – the latter two of which contain more NdFeB per vehicle, on average.

## NdFeB Magnet Deployment in Passenger EV Traction Motors by EV Type in April 2022





# Supply-Side Market Developments (1/2)

## Arafura Resources and Hyundai Motor Company Sign Non-Binding MoU for NdPr Oxide Offtake

In May, Australian rare earths developer, Arafura Resources, announced a non-binding 7-year offtake agreement with Hyundai Motor Company for supply of approximately 1,000 to 1,500 tonnes of NdPr oxide annually starting from 2025.

The duo is working towards executing a binding agreement by September 2022 and will work towards engaging “relevant Export Credit Agencies to access debt funding and guarantees linked with critical materials procurement for use in Korean based manufacturing”, Arafura announced.

The definitive and binding offtake agreement would be subject to the condition that Arafura secure project financing and complete construction, development and commissioning of its “shovel-ready” Nolans project in Australia.

Arafura is targeting full production capacity at Nolans in 2027, after which it is expected to produce an average of 4,400 tonnes of NdPr oxide annually - upwards of one-third of which would be committed to Hyundai as per this agreement.

According to Arafura, NdPr oxide pricing would be determined quarterly “using a formula-based mechanism referencing the NdPr oxide Ex Works China price per tonne” and would include a discount in recognition of the long-term offtake agreement.

**Adamas take:** While some questions remain (e.g., how will Arafura’s NdPr oxide be turned into Hyundai’s magnets?), the announcement is great news for both Arafura and Hyundai.

Hyundai and affiliate Kia collectively sell around 7 million vehicles annually and aim to fully electrify their output in most markets by 2035.

With an industry average of approximately 1.5 kilograms of NdFeB magnets per EV traction motor, Hyundai-Kia are rapidly speeding towards magnet demand of around 6,000 to 10,000 tonnes annually and NdPr oxide demand (at the NdFeB alloy stage) of 2,700 to 4,500 tonnes annually by 2035 suggesting it needs to double or triple its current commitments.

## USA Rare Earth to Build \$100M Rare Earth Metal and Magnet Plant in Oklahoma

Earlier this month USA Rare Earth, owner of the Round Top heavy rare earth and critical minerals project in Texas, announced plans to build a \$100 million plant in Stillwater, Oklahoma, to convert rare earth oxides into metals, magnets and other specialty materials.

In 2020, USA Rare Earth acquired sintered NdFeB magnet manufacturing equipment from Hitachi Metals. The company is aiming to secure operating permits for its new plant in 2022 and will commence production in 2023, creating around 100 jobs.

**Adamas take:** Yet another positive step forward for the re-establishment NdFeB magnet production capacity in the U.S.

We don’t expect that the company will have its Round Top mine operational within the next two years thus anticipate it will look to third parties for magnet rare earth oxide supplies in the interim.

Towards that end, in late-2021 USA Rare Earth and Search Minerals announced a non-binding

MoU for offtake of 500 tonnes per annum of NdPr oxide from future production at Search’s Deep Fox or Foxtrot deposits.

## Search Minerals Announces Positive PEA Results for Deep Fox and Foxtrot Project in Canada

Earlier this month Search Minerals announced results of a Preliminary Economic Assessment (“PEA”) completed on its Deep Fox and Foxtrot rare earth project in Labrador, Canada.

Following an initial capital cost of CAD \$422 million, Search aims to start production from the project by 2025, operating for a 26-year mine life.

Mineralized material from the deposits will be physically upgraded and stockpiled in Labrador, and “seasonally transported to a secondary hydrometallurgical plant on the island on Newfoundland” for conversion into a mixed rare earth carbonate concentrate, according to the announcement.

Thereafter, the mixed rare earth carbonate will be toll-processed into separated oxides (as assessed in the PEA) or may be separated in-house, pending results from additional engineering and feasibility studies.

Oxides would then be shipped to market, including USA Rare Earth, which has a non-binding MoU with Search for offtake of 500 tonnes of NdPr oxide annually, as noted earlier.

**Adamas take:** A positive PEA result from one of the original rare earth developers in the space. We appreciate the measured and staged approach Search is taking to “sprint” the project into production and look forward to following its advance.



# Supply-Side Market Developments (2/2)

## Lynas Secures \$120M Contract for U.S. Heavy Rare Earths Plant

Earlier this month, Lynas Rare Earths' U.S.-based subsidiary secured a \$120 million contract with the U.S. Department of Defense ("DoD") to build a commercial heavy rare earth oxide separation plant in Texas.

The contract builds on earlier 'Phase 1' funding for the plant announced 12 months ago.

The plant is expected to be built along the Texas Gulf Coast and operational by 2025.

Lynas plans to co-locate a light rare earth separation plant alongside the heavy plant, which will be half-funded by the Defense Production Act ("DPA") office of the U.S. DoD.

Once operational, Lynas' heavy rare earths separation plant and the earlier-announced heavy plant of MP Materials will be the only facilities outside of China with the ability to separate heavy rare earth oxides, which are critical for high-performance magnets for EVs plus a wide array of defense-related applications.

Lynas, which mines rare earths in Australia and currently separates into oxides in Malaysia, aims to increase production by 50% by 2025 to capitalize on the market's demand growth.

**Adamas take:** Encouraging to see the U.S. DoD backing two heavy rare earth oxide separation plants. Both will be imminently needed as NdFeB production ramps up in the U.S.

That said – with Lynas' value chain stopping at oxides, its clear that emerging metal and magnet makers MP Materials, VAC, USA Rare Earth and others will be key to closing the gap in the U.S.

supply chain and ensuring that U.S.- and ally-mined materials can be fully upgraded and converted domestically into the magnets and materials that commercial and defense-related end-users want and need.

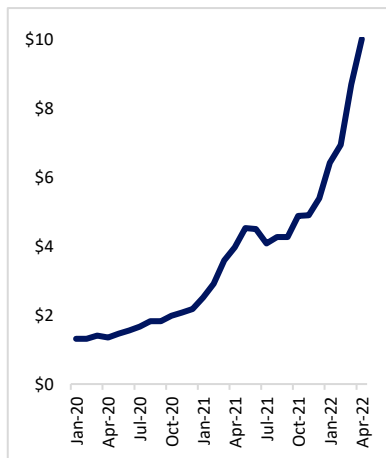
## Volume of China Mineral Concentrate Imports from U.S. Down, Price Up in April 2022

In April 2022, China imported 6,260 tonnes of bastnaesite mineral concentrate from the U.S., 45.3% less than it imported the month prior but 11.9% more than it imported the same month the year prior.

By value, China imported \$62.6 million worth of bastnaesite mineral concentrate from the U.S. in April 2022, 37.0% lower than the month prior but 182.6% higher than the same month the year prior.

Moreover, the average price paid in China for U.S. bastnaesite mineral concentrate in April 2022 was a record \$10.01 per kilogram, 15.1% higher than the month prior and 152.6% higher than the same month the year prior.

## China bastnaesite import price from U.S. since January 2020 (USD/kg) – Up 665%

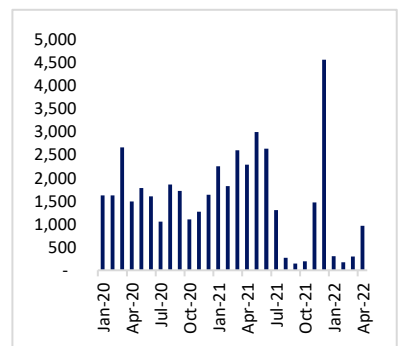


## China Mixed REO Concentrate Imports Up, Carbonate Imports Down in April 2022

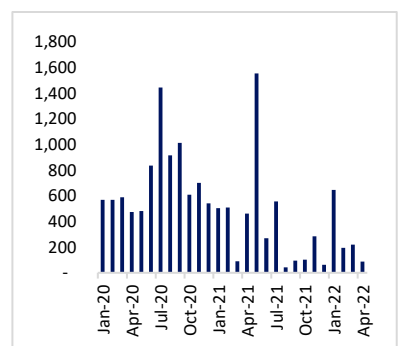
In April 2022, China imported 964 tonnes of mixed rare earth oxide concentrate (mostly from Myanmar), 217.6% more than it imported the month prior but 57.6% less than it imported the same month the year prior as import volumes from Myanmar continue to be suppressed by pandemic-related border closures and other challenges.

Conversely, in April 2022, China imported a mere 87 tonnes of mixed rare earth carbonate, 60.1% less than it imported the month prior and 81.0% less than the same month the year prior as carbonate imports from Myanmar have ground to a halt.

## China mixed REO concentrate imports since January 2020 (tonnes)



## China mixed REE carbonate concentrate imports since January 2020 (tonnes)





# Demand-Side Market Developments

## Nidec to Build Flagship E-Axle Plant in Zhejiang, China

Nidec Corporation will build a flagship factory for E-Axles in Pinghu, Zhejiang Province, China, the company revealed earlier this month at a signing ceremony in the nation.

Construction is slated to start in October of this year and production in October 2023 with capacity to produce 1 million units per annum.

Nidec is targeting global sales of \$78 billion by 2030 across all business segments and its electric vehicle traction motor business in particular is expected to drive strong growth.

Through the first four months of 2022, Nidec sold more than 370,000 E-Axles in China alone and its global sales volume is expected to top 1 million units by year-end.

The Zhejiang factory will be Nidec's fifth EV motor factory in China and its seventh worldwide.

The company plans to invest \$2.3 billion through 2025 to lift its global E-Axle production capacity to 7 million units annually.

At present, Nidec is a key motor and E-Axle supplier to Stellantis, GAC and Geely. All of the company's EV motors to-date have been PMSMs.

## Hyundai to Establish First Dedicated EV and Battery Manufacturing Plant in U.S.

In late-May, Hyundai Motor Group announced plans to build electric vehicle and battery manufacturing facilities in Bryan County, Georgia.

Following a \$5.54 billion investment, the plant will commence production in 2025

with capacity to produce 300,000 units per annum.

Hyundai Motor Group (which includes affiliate Kia) targets global battery electric vehicle sales of 3.23 million units annually by 2030 and aims to become one of the top three EV providers in the U.S. by 2026.

## Vitesco Releases New Electrically-Excited Synchronous Motor

Recently, Vitesco Technologies, formerly part of Continental, revealed its new EMR4 E-Axle which includes an electrically-excited synchronous motor ("EESM"), inverter and reducer in one package.

The new EMR4 builds on the earlier EMR3 to provide an integrated, modularized and scalable platform covering a power range from 80 kW to 230kW while reducing weight by 25%.

According to Vitesco, because the range of typical battery electric vehicles continues to increase, EESMs can be advantageous for long-distance and high-speed driving.

At lower speeds, however, we understand that the efficiency of Vitesco's EESM is lower than that of a comparable PMSM.

Moreover, EESMs use slip rings, which are a potential wear item and can present heat dissipation issues.

Currently, Renault and BMW are the primary users of EESMs in certain EV models.

However, last month it was revealed that Hyundai Motor Group will use the EMR4 for its new global B/C-segment EVs in 2024, making it the third major

OEM to dabble with EESMs.

## China REO Exports Up 10.9% Through First 5 Months of 2022

According to data from China's General Administration of Customs ("GAC"), the nation exported a total of 21,970 tonnes of rare earth materials through the first five months of 2022, up 10.9% over the same period the year prior.

By value, China exported a whopping \$0.46 billion worth of rare earth materials from January through May 2022, 89.9% more than it exported over the same five months the year prior.

## China NdFeB Magnet Exports Up 7.7% in April 2022

In April 2022, China exported 4,601 tonnes of NdFeB magnets, up 7.7% month-over-month and 18.0% over the same month the year prior.

Through the first four months of 2022, China exported 17,381 tonnes of NdFeB magnets, 21.6% more than it exported over the same period the year prior.

Moreover, from January through April 2022, the average price paid for NdFeB exports from China was \$72.51 per kilogram, up 38.8% from \$52.23 per kilogram over the same four months the year prior.

In April 2022, Germany imported 615 tonnes of NdFeB magnets from China, down 5.7% from the month prior but up 5.3% over the same month the year prior.

Conversely, in April 2022 the U.S. imported 603 tonnes of NdFeB magnets from China, up 17.9% month-over-month and 20.5% over the same month the year prior.



# Rare Earth Oxide Price Developments

## NdPr Oxide Price Up 0.7%, Nd Oxide Price Up 1.0% and Pr Oxide Price Up 9.0% in May 2022

In May 2022, the month-end NdPr oxide price was up 0.7%, the month-end Nd oxide price was up 1.0%, and the month-end Pr oxide price was up 9.0% month-over-month, trending higher again following the short-lived reconvergence of industry guidance and spot market prices in China.

Spot market NdPr oxide and Nd oxide prices were around \$142 and \$146 per kilogram, respectively, at May month-end, versus a lower \$122 and \$133 per kilogram, respectively, quoted by China Northern Rare Earth Group.

## Dy Oxide Price Down 3.8% in May 2022 on China Pandemic Lockdowns, Fall in Manufacturing Output

Following a 12.9% drop in April, the May month-end price of Dy oxide fell another 3.8% month-over-month owing to China's strict pandemic lockdowns and the resultant drop in manufacturing output from key end-use industries, including automotive.

As of early June, the price of Dy oxide in China was holding steady at May's lower levels, foreshadowing another lackluster month ahead.

## Tb Oxide Price Down 5.0% in May 2022 on China Pandemic Lockdowns, Fall in Manufacturing Output

Following 1.0% rise in April, the May month-end price of Tb oxide dropped 5.0% versus the month-end prior due to China's strict pandemic lockdowns and the resultant drop in manufacturing output from key end-use industries, including automotive.

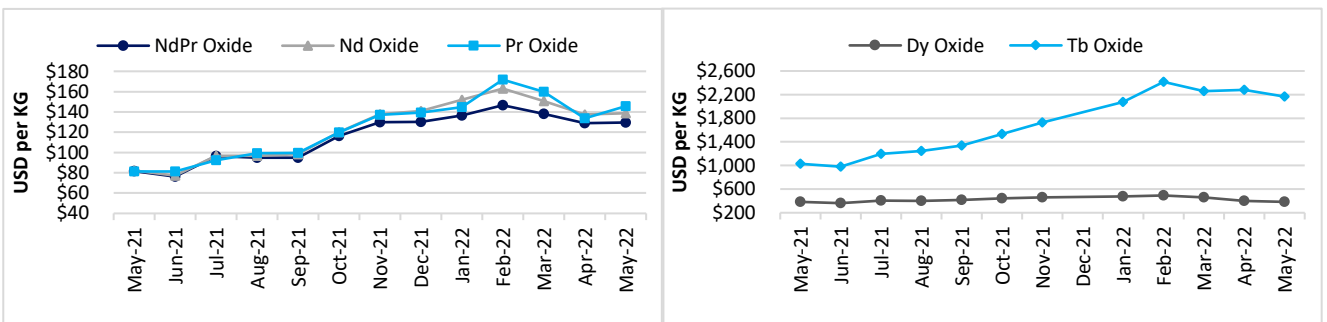
As of early June, the price of Tb oxide in China was holding steady at May's lower levels, foreshadowing another lackluster month ahead for heavy rare earth prices.

## Following the Brief Reconvergence of Light Rare Earth Spot and Industry Guidance Prices in April, Light Spot Market Prices Jumped Higher Again in May

Following the formation of an unprecedented gap between China spot prices and China Northern Rare Earth Group industry guidance prices in early 2022, spot prices dropped in March and April, reconverging with industry guidance prices as we expected.

In May, light rare earth spot prices jumped higher again while heavy rare earth prices were subdued. As of early June, prices were hovering rangebound at May month-end levels, foreshadowing a tame month ahead.

### Following the Brief Reconvergence of Light Rare Earth Spot and Industry Guidance Prices in April, Spot Market Prices Jumped Higher Again in May



(USD per KG)	May-21	Jun-21	Jul-21	Aug-21	Sep-21	Oct-21	Nov-21	Dec-21	Jan-22	Feb-22	Mar-22	Apr-22	May-22
NdPr Oxide													
Δ MoM													
Nd Oxide													
Δ MoM													
Pr Oxide													
Δ MoM													
Dy Oxide													
Δ MoM													
Tb Oxide													
Δ MoM													

Full table visible to subscribers

\* Prices reflect the estimated global volume-weighted average at month-end (including 13% VAT) converted to USD at month-end FX rates



# Rare Earth Metal Price Developments

## NdPr Metal Price Up 1.2%, Nd Metal Price Up 0.3% and Pr Metal Price Up 1.1% in May 2022

In May 2022, the month-end prices of NdPr alloy and Nd metal were up 1.2% and 0.3%, respectively, versus the month-end prior, led by comparable rises in NdPr and Nd oxide input prices over the same period.

Spot market NdPr alloy and Nd metal prices were around \$173 and \$177 per kilogram, respectively, at May month end, versus a lower \$148 and \$162 per kilogram, respectively, quoted by China Northern Rare Earth Group.

## Dy Metal Price Down 9.1%, Fe-Dy Alloy Down 3.0% as Dy Oxide Input Costs Fall in May 2022

In May 2022, the month-end Dy metal and Fe-Dy alloy prices were down 9.1% and 3.0%, respectively, versus the month-end prior on the back of a 3.8% drop in the price of Dy oxide over the same period.

With the price of Dy oxide holding steady at May's lower levels in early June on China's pandemic lockdowns and associated manufacturing woes, we expect Dy metal and Fe-Dy alloy prices to hold steady or trend slightly lower in the weeks ahead.

## Tb Metal Price Down 0.2% Month-over-Month as Tb Oxide Input Costs Fall Slightly in May 2022

In May 2022, the month-end Tb metal price was down 0.2% from the month-end prior, undercut by a 5.0% drop in the price of Tb oxide over the same period.

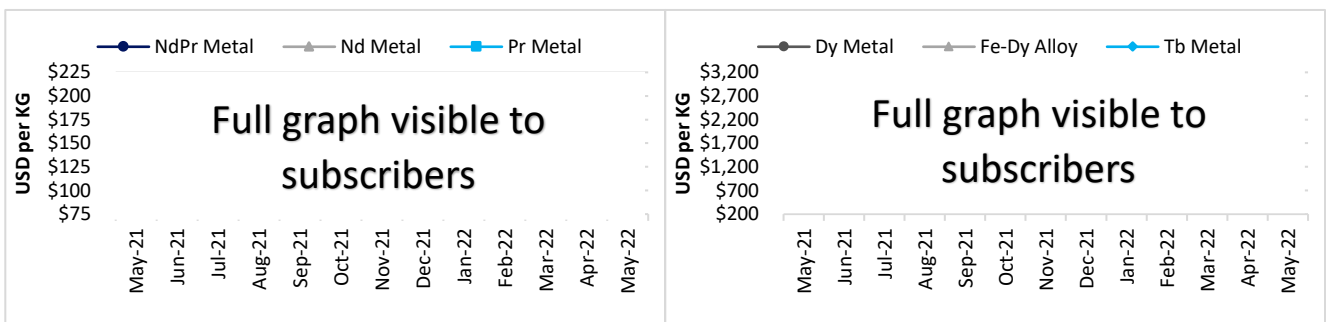
With the price of Tb oxide holding steady at May's lower levels in early June on China's pandemic lockdowns and associated manufacturing slowdowns, we expect Tb metal prices to hold steady or trend slightly lower in the weeks ahead.

## Metal and Alloy Prices Followed Oxide Prices in May, Prices Expected to Hold Steady of Trend Slightly Lower in Weeks Ahead

In May, magnet rare earth metal and alloy prices loosely followed oxide price movements, which were generally subdued by China's lockdowns and the persistence of industry guidance prices at lower levels.

Looking forward, with magnet rare earth oxide prices trending sideways in early June, we expect magnet rare earth metal and alloy prices to follow suit.

### Metal and Alloy Prices Followed Oxide Prices in May, Prices Expected to Hold Steady of Trend Slightly Lower in Weeks Ahead



(USD per KG)	May-21	Jun-21	Jul-21	Aug-21	Sep-21	Oct-21	Nov-21	Dec-21	Jan-22	Feb-22	Mar-22	Apr-22	May-22
NdPr Metal													
Δ MoM													
Nd Metal													
Δ MoM													
Pr Metal													
Δ MoM													
Dy Metal													
Δ MoM													
Fe-Dy Alloy													
Δ MoM													
Tb Metal													
Δ MoM													

Full table visible to subscribers

\* Prices reflect the estimated global volume-weighted average at month-end (including 13% VAT) converted to USD at month-end FX rates



# NdFeB Alloy Price Developments

## SH Grade NdFeB Alloy Prices Down 1.6% Month-over-Month in May 2022

In May 2022, the month-end price of N40SH NdFeB alloy in China was 426 RMB per kg, up from 415 RMB the month prior and 266 RMB per kg the same month the year prior.

In USD terms, the month-end price fell 1.6% month-over-month to USD \$63.62 per kg in May 2022 following a pronounced drop in the RMB to USD exchange rate.

## UH Grade NdFeB Alloy Prices Down 2.1% to 2.2% Month-over-Month in May 2022

In May 2022, the month-end price of N35UH NdFeB alloy in China was 536 RMB per kg, up from 525 RMB per kg the month prior, while the month-end price of N38UH NdFeB alloy in China was 551 RMB per kg, up from 540 RMB per kg the month prior.

In USD terms, the month-end price of N35UH grade alloy fell 2.1% month-over-month to USD \$80.05 per kg in May 2022, while the month-end price of N38UH grade alloy fell 2.2% month-over-month to USD \$82.29 per kilogram.

## EH Grade NdFeB Alloy Prices Down 2.2% Month-over-Month in May 2022

In May 2022, the month-end price of N38EH NdFeB alloy in China was 571 RMB per kg, up from 560 RMB the month prior and 411 RMB per kg the same month the year prior.

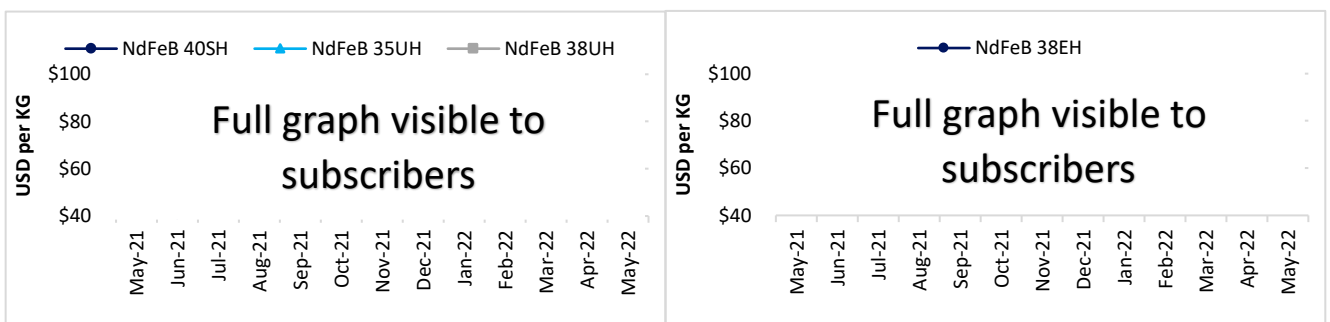
In USD terms, the month-end price fell 2.2% month-over-month to USD \$85.27 per kg in May 2022 following a major dip in the RMB to USD exchange rate.

## NdFeB Alloy Prices Up in May in RMB Terms, Down in USD Terms Following 4.1% Drop in RMB to USD FX Rate

In May 2022, NdFeB alloy prices rose in RMB terms following comparable increases in didymium and neodymium oxide and metal prices but fell by 1 to 2% in USD terms following a 4.1% drop in the RMB to USD exchange rate.

Looking forward, with magnet rare earth oxide, metal and alloy prices expected to move sideways in the weeks ahead, or decrease slightly, we expect NdFeB alloy prices to also trend sideways at May month-end price levels.

### NdFeB Alloy Prices Up in May in RMB Terms, Down in USD Terms Following 4.1% Drop in RMB to USD FX Rate



(USD per KG)	May-21	Jun-21	Jul-21	Aug-21	Sep-21	Oct-21	Nov-21	Dec-21	Jan-22	Feb-22	Mar-22	Apr-22	May-22
NdFeB 40SH													
Δ MoM													
NdFeB 35UH													
Δ MoM													
NdFeB 38UH													
Δ MoM													
NdFeB 38EH													
Δ MoM													

Full table visible to subscribers

\* Prices reflect estimated China domestic prices at month-end (including 13% VAT) converted to USD at month-end FX rates

Source: Adamas Intelligence

\* Prices are for bulk sintered NdFeB alloy precursor, not finished and coated magnets





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