Your guide to Vale’s plating portfolio
Our Premium Nickel Plating Anodes

Plating Rounds™

S-Pellets™

P-Pellets™

Plating Chips™
Most forms of nickel anode materials were Vale innovations:
• First to pioneer the easiest-handling anode shapes.
• First to develop fully-activated forms, a recognized industry breakthrough.
• Only company to offer carbonyl nickel plating products.

Why partner with Vale for nickel plating anodes?

High-quality, reliable and worry-free products.
• Our nickel anode materials deliver high-quality plating around the world.
• We’ve set the standard for nickel anode materials since the 1930s.
• Quality management systems for the production, packaging and marketing of our carbonyl nickel products have been registered and comply with the requirements of ISO 9001, ISO 14001 and OHSAS 18001.

Quality plating facilities trending to smaller nickel forms.
• Vale makes some of the most unique plating products in the world. Our portfolio of products provide ease-of-use and quality plating performance. Further, our nickel forms can be used in any application — from decorative work to plating on plastics, engineered products and electronics.

Global reach, local contact.
• We are committed to continuing to supply high quality nickel anodes to the plating industry.
• As a global company with production and sales offices around the world, we can serve your needs from an office near you.
• We back up our products and our customers with old-fashioned service and an understanding of your business and business environment.

Technical support.
To help you operate as efficiently as possible, we will:
• Send you plating literature.
• Come to you with presentations on technical issues that can affect your productivity and results.
• Give you help and advice to get the most from your process.

More reliable availability.
• With global reach and a broad range of products, more distributors around the world prefer to deal with Vale.
• More distributors mean more reliable product availability for you.
Our Plating Rounds™ now bring you even higher standards of exceptional quality for electroplating with baskets and the Vale stamp for quality assurance. They are produced via our hydromet electrolytic refining process at our Long Harbour Processing Plant in Newfoundland and Labrador, Canada.

Benefits and characteristics of Plating Rounds™:

- Cause no bridging or voids while loading baskets — their unique shape, size and smooth edges settle the load uniformly into standard and shaped titanium anode baskets of various mesh sizes.
- Prevent poor plating, hot spots or physical damage to titanium baskets due to nickel voids.
- Ensure good electrolyte flow and mixing through the basket, enabling uniform current density and high-quality deposits.
- Provide full coverage across the basket surface using ~15% less nickel than Thompson R-Rounds™ due to their larger diameter and lower packing density.
- Handle more safely than squares (no sharp edges to injure workers).
- Require lower voltages — better contact points between Plating Rounds™ and with titanium baskets have proven to lower contact resistance and lower power consumption compared to cut cathode.
- Dissolve at 100% anode efficiency in common nickel plating solutions (containing chlorides).

Form:
Button-shaped pieces of nickel about 25–29 mm in diameter and about 6 mm thick

Packing density:
About 3.6 kg/dm³ of basket capacity

Typical chemical analysis (%)

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Nickel*</td>
<td>&gt;99.95</td>
</tr>
<tr>
<td>Cobalt</td>
<td>&lt;0.030</td>
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<tr>
<td>Sulphur</td>
<td>&lt;0.005</td>
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<td>Copper</td>
<td>&lt;0.0002</td>
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<td>Arsenic</td>
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<td>Carbon</td>
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<td>&lt;0.0001</td>
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<tr>
<td>Iron</td>
<td>&lt;0.002</td>
</tr>
<tr>
<td>Zinc</td>
<td>&lt;0.0002</td>
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</tbody>
</table>

* Nickel determined by difference
Nickel P-Pellets™ are a high-purity form of cobalt-free nickel widely used for electroplating with titanium anode baskets. These very pure, non-activated spheres are exclusively produced by our unique carbonyl gas refining process at the Clydach Nickel Refinery in Wales, UK and the Copper Cliff Nickel Refinery in Sudbury, Canada.

Benefits and characteristics of P-Pellets™:
- Excellent flowability makes them ideal for shaped and conforming baskets.
  - Great for use with automated or semi-automated loading systems to save labour
  - Keep baskets filled at all times.
- Spherical shape makes them settle uniformly without bridging, prolonging the life of your titanium baskets — you can design baskets to fit your precise needs.
- Exceptional packing density and large surface area leads to improved dissolution properties and more uniform deposit thickness.
- Easy to use and safe to handle.
- Similar to non-activated electrolytic products in that they require the presence of chlorides to dissolve at 100% anode efficiency.
- Carbonyl refining produces the lowest metallic impurities in commercially available nickel.

<table>
<thead>
<tr>
<th>Form:</th>
</tr>
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<tbody>
<tr>
<td>Spherical pieces of nickel 8–12 mm in diameter</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Packing density:</th>
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</thead>
<tbody>
<tr>
<td>About 5.3 kg/dm³ of basket capacity</td>
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<table>
<thead>
<tr>
<th>Typical chemical analysis (%)+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nickel*</td>
</tr>
<tr>
<td>Sulphur</td>
</tr>
<tr>
<td>Cobalt</td>
</tr>
<tr>
<td>Copper</td>
</tr>
<tr>
<td>Iron</td>
</tr>
<tr>
<td>Zinc</td>
</tr>
<tr>
<td>Carbon</td>
</tr>
<tr>
<td>Lead</td>
</tr>
</tbody>
</table>

* Nickel by difference
+ Sudbury P-Pellets shown

Packaging options:
- 10 kg (22 lb.) plastic bags
  5 bags per box, 20 boxes per pallet
  Net weight 1,000 kg (2,204 lbs.)
- 1,000 kg bulk bag (2,204 lbs.)
- 2,000 kg bulk bag (4,408 lbs.)
Plating Chips™
Carbonyl Nickel Anode

Smooth, high-purity and ideal for electroplating with titanium anode baskets

These high-purity, cobalt-free nickel chips are completely compatible and interchangeable with electrolytic nickel squares, but offer several significant advantages over squares. They are produced by our unique, proprietary carbonyl gas refining process at our Clydach Nickel Refinery in Wales, UK and our Copper Cliff Nickel Refinery in Sudbury, Canada.

Benefits and characteristics of Plating Chips™:

• Unique shape pours easily, can be scooped safely (no sharp edges), and prevents bridging and voids
  – Chips flow easily into regular baskets with standard mesh sizes while extending the life of your baskets.
  – Prevent electrochemical damage to titanium baskets.

• Hard-to-reach baskets can be loaded using plastic tubes.
• Uniform settling (far better than squares) ensures even current distribution, improved coating thickness uniformity and high-quality deposits.
• Dissolves at 100% anode efficiency in common nickel-plating solutions (containing chlorides).
• Carbonyl refining produces the lowest metallic impurities in commercially available nickel.

Product description

Form:
Coin-like pieces of nickel averaging 4–5 mm thick and with 80% > 17 mm

Packing density:
About 5.0 kg/dm³ of basket capacity

Typical chemical analysis (%)+

<table>
<thead>
<tr>
<th>Element</th>
<th>Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nickel*</td>
<td>&gt;99.98</td>
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<tr>
<td>Sulphur</td>
<td>&lt;0.0001</td>
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<tr>
<td>Cobalt</td>
<td>&lt;0.0002</td>
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<tr>
<td>Copper</td>
<td>&lt;0.0004</td>
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<tr>
<td>Iron</td>
<td>&lt;0.0006</td>
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<tr>
<td>Zinc</td>
<td>&lt;0.0004</td>
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<tr>
<td>Carbon</td>
<td>&lt;0.007</td>
</tr>
<tr>
<td>Lead</td>
<td>&lt;0.00002</td>
</tr>
</tbody>
</table>

* Nickel by difference
+ Sudbury Chips shown

Packaging options:

• 10 kg (22 lb.) plastic bags
  5 bags/box; 20 boxes/pallet
  Net weight 1,000 kg (2,204 lbs.)

• 250 kg (551 lb.) steel drums
  4 per pallet
  Net weight 1,000 kg (2,204 lbs.)

• 1,000 kg bulk bag (2,204 lbs.)
• 2,000 kg bulk bag (4,408 lbs.)
S-Pellets™
Sulphur-activated Carbonyl Nickel Anode

Excellent for electroforming and electroplating — especially popular for electroforming at high current densities

Vale’s high-quality, cobalt-free activated S-Pellets™ are very similar to our non-activated products in nickel content and purity. They are only different in that they contain a minute amount of evenly-distributed sulphur (absolutely no sulphur is deposited at the cathode).

- Their spherical shape is produced by a unique carbonyl gas refining process at Vale’s Clydach Nickel Refinery in Wales, UK.
- Carbonyl refining produces the purest form of commercially available nickel.
- The activation is achieved by adding a small, controlled amount of sulphur to the nickel during refining.

Benefits and characteristics of S-Pellets™:

- Pellet shape is perfect for use with conforming baskets designed to follow the contours of articles being plated or electroformed.
- Pellets pour easily into the basket directly from their bags, or with manual or automatic loading devices.
- Improved dissolution and settling protects baskets from electrochemical attack (titanium may corrode if not in direct contact with actively-dissolving nickel).
- Fully active for smooth, uniform dissolutions:
  - Dissolve at 100% anode efficiency in all nickel plating solutions, even those without chlorides, and leave low levels of unwanted residues.
- Cut energy costs:
  - The minute addition of sulphur lowers nickel anodes’ dissolution potential by 400 millivolts; the lower the dissolution potential, the less energy required to dissolve the anode.
  - Low dissolution voltage results in significant power and cost savings. The sulphur does NOT enter solution; it forms an insoluble nickel sulphide residue that removes copper impurities from the plating solution.
- Chloride content of bath no longer critical:
  - Unlike non-active nickel, sulphur-activated anode materials dissolve at 100% efficiency in all baths, even those without chloride ions.
  - Electroformers can eliminate chlorides completely to avoid the distortion that results from high internal stress on the cathode caused by their presence.
- Remove copper impurities:
  - All nickel anodes form residues. Non-activated nickel leaves a metallic residue. But, activated nickel produces mostly a non-metallic nickel sulphide residue, which actually removes copper impurities from the bath.
  - This lessens copper build-up, and makes bath maintenance easier.

Product description

<table>
<thead>
<tr>
<th>Form:</th>
<th>Spherical pieces of nickel 6–14 mm diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Packing density:</td>
<td>About 5.4 kg/dm³ of basket capacity</td>
</tr>
<tr>
<td>Typical chemical analysis (%)</td>
<td></td>
</tr>
<tr>
<td>Nickel*</td>
<td>&gt;99.97</td>
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<tr>
<td>Sulphur</td>
<td>~0.022-0.030</td>
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<tr>
<td>Cobalt</td>
<td>&lt;0.00002</td>
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<tr>
<td>Copper</td>
<td>&lt;0.0001</td>
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<tr>
<td>Iron</td>
<td>&lt;0.004</td>
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<td>Zinc</td>
<td>&lt;0.00002</td>
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<tr>
<td>Carbon</td>
<td>&lt;0.005</td>
</tr>
<tr>
<td>Lead</td>
<td>&lt;0.000001</td>
</tr>
</tbody>
</table>
* Nickel by difference

Packaging options:

- 10 kg (22 lb.) plastic bags (5/per box; 20 boxes/pallet Net weight 1,000 kg (2,204 lbs.)
- 1,000 kg bulk bag (2,204 lbs.)
Plating Rounds™

Plating Rounds™ are a high-purity form of electrolytic nickel specifically designed for electroplating with titanium anode baskets.

The controlled and consistent quality of Plating Rounds™ and their distinctive shape and size make them ideally suited for plating of high quality products:

- High-purity nickel
- Unique shape prevents the formation of bridges and voids in the basket
- Unique shape ensures good solution flow and mixing through the basket
- Setstle uniformly in basket, ensuring uniform current density and high-quality deposits
- Flows easily into regular and shaped baskets of various mesh sizes
- Safe to handle (no sharp edges)
- Dissolves at 100% anode efficiency in common nickel plating solutions (containing chlorides)

Vale’s Long Harbour Processing Plant manufactures Plating Rounds™ using a state-of-the-art hydrometallurgical process in Newfoundland, Canada.

For more information visit vale.com, email plating@vale.com or contact your regional sales representative.

Product description

Form
- Button-shaped pieces of nickel
- Diameter: approximately 25-29 mm
- Thickness: approximately 5-6 mm
- Weight per piece: 26-32 grams

Packing density
Approximately 3.6 g/cm³ of basket capacity

Packaging options
- 10 kg bags — 5 bags per box, 20 boxes per pallet (1,000 kgs net weight)
- 250 kg steel drums, 4 drums per pallet
- 1,000 kgs bulk bags
- 2,000 kgs bulk bags

Typical analysis (wt %)
- Ni* >99.95
- Co <0.030
- Cu <0.0002
- C <0.008
- Fe <0.002
- S <0.005
- As <0.0001
- Pb <0.0001
- Zn <0.0002

* Nickel determined by difference

Nickel P-Pellets™

Nickel P-Pellets™ are a high-purity form of nickel widely used for electroplating with titanium anode baskets. P-Pellets™ are produced by a unique carbonyl gas refining process at the Copper Cliff Nickel Refinery in Sudbury, Canada.

The controlled and consistent purity of P-Pellets™ and the advantages associated with its distinctive shape make this product ideal for general purpose plating with titanium anode baskets:

- Carbonyl refining produces the purest form of nickel available
- Unique shape prevents the formation of bridges and voids in the basket
- Setstle uniformly in basket, ensuring uniform current density and high-quality deposits
- Flows easily into regular and shaped baskets with standard mesh sizes
- Ideal for use with automated basket loading devices
- Safe to handle (no sharp edges)
- Dissolves at 100% anode efficiency in common nickel plating solutions (containing chlorides)

Dissolution produces a small amount of metallic residue, which can be contained using cloth anode bags.

P-Pellets™ are produced in compliance with the following ISO 9001 standards.

For more information visit vale.com, email plating@vale.com or contact your regional sales representative.

Product description

Form
- Spherical pieces of nickel
- Diameter: approximately 8–12 mm

Packing density
Approximately 5.3 g/cm³ of basket capacity

Packaging options
- 10 kg bags — 5 bags per box, 20 boxes per pallet (1,000 kgs net weight)
- 1 tonne bulk bags
- 2 tonne bulk bags

Chemical analysis (wt %)
- Ni* >99.98
- Co <0.00002
- Cu <0.00004
- C <0.007
- Fe <0.0006
- S <0.0001
- Pb <0.000002
- Zn <0.00002

* Nickel determined by difference

Updated: November 2018
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Nickel Plating Chips™ are a high-purity form of nickel specifically designed for electroplating with titanium anode baskets. Chips™ are produced by a unique carbonyl gas refining process at the Copper Cliff Nickel Refinery in Sudbury, Canada.

The controlled and consistent purity of Chips™ and the advantages associated with their distinctive shape make this product attractive for general purpose plating with titanium anode baskets:

- Carbonyl refining produces the purest form of nickel available
- Unique shape prevents the formation of bridges and voids in the basket
- Sets uniform deposits, ensuring uniform current density and high-quality deposits
- Flows easily into regular baskets with standard mesh sizes
- Safe to handle (no sharp edges)
- Dissolves at 100% anode efficiency in common nickel plating solutions
- Proven and trusted by the world’s leading electroplaters

Dissolution produces a small amount of metallic residue, which can be contained using cloth anode bags.

Chips™ are produced in compliance with ISO standards.

For more information visit vale.com, email plating@vale.com or contact your regional sales representative.

### Chemical analysis (wt %)

<table>
<thead>
<tr>
<th>Element</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ni*</td>
<td>&gt;99.99</td>
</tr>
<tr>
<td>Co</td>
<td>&lt;0.0002</td>
</tr>
<tr>
<td>Cu</td>
<td>&lt;0.0004</td>
</tr>
<tr>
<td>C</td>
<td>&lt;0.007</td>
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<td>Fe</td>
<td>&lt;0.006</td>
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<tr>
<td>S</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Pb</td>
<td>&lt;0.000002</td>
</tr>
<tr>
<td>Zn</td>
<td>&lt;0.0002</td>
</tr>
</tbody>
</table>

* Nickel determined by difference

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Nickel S-Pellets™ are a high-purity form of sulphur-activated nickel widely used for electroplating with titanium anode baskets. S-Pellets™ are produced by a unique carbonyl gas refining process at the Clydach Nickel Refinery in the UK.

The controlled and consistent purity of S-Pellets™ and the advantages associated with its distinctive shape and sulphur activation make this product attractive for high-end plating (e.g., high-speed engineering, electronics, electroforming) with titanium anode baskets:

- Carbonyl refining produces the purest form of nickel available
- Sulfur activation promotes uniform dissolution and low operating voltage, even in chloride-free plating baths
- Unique shape prevents the formation of bridges and voids in the basket
- Sets uniform deposits, ensuring uniform current density and high-quality deposits
- Flows easily into regular and shaped baskets with standard mesh sizes
- Ideal for use with automated basket loading devices
- Safe to handle (no sharp edges)
- Dissolves at 100% anode efficiency in common nickel plating solutions — with or without chlorides
- Dissolution produces minimal metallic residues

The sulphur in this product does not enter the plating solution; it forms an insoluble nickel sulphide residue, which is 100% contained using cloth anode bags, where it acts to remove unwanted copper impurities.

S-Pellets™ are produced in compliance with the following standards: ISO 9001, ISO 14001 and OHSAS 18001.

For more information visit vale.com, email plating@vale.com or contact your regional sales representative.

### Chemical analysis (wt %)

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>Ni</td>
<td>&gt;99.97</td>
</tr>
<tr>
<td>Co</td>
<td>&lt;0.00002</td>
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<tr>
<td>Cu</td>
<td>&lt;0.0001</td>
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<tr>
<td>C</td>
<td>&lt;0.005</td>
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<tr>
<td>Fe</td>
<td>&lt;0.004</td>
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<tr>
<td>S</td>
<td>&lt;0.002-0.010</td>
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<tr>
<td>Pb</td>
<td>&lt;0.000001</td>
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<tr>
<td>Zn</td>
<td>&lt;0.00002</td>
</tr>
</tbody>
</table>

* Nickel determined by difference
Global Support
We serve our plating customers through regional offices around the world.

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