Neodymium Iron Boron magnets

Corrosion process

Before exposure in humid air

O₂ + H₂O

Nd rich phase

Nd₂Fe₁₄B

Nd(OH)₃

Thick grain boundaries

Thin grain boundaries

After exposure in humid air
Neodymium Iron Boron Magnets
Better corrosion resistance is achieved by:

• Minimizing the Neodymium rich phase
• Developing corrosion resistant intermetallic compounds as the grain boundary phase
• Avoiding open porosity, cracks, laminations, etc.
• Designing with minimum surface area.
Improvements to NdFeB Magnet Corrosion Resistance

(Highly Accelerated Stress Test: 130°C, 2.7 bar;
100% Relative Humidity; Bare Magnets)

![Graph showing improvements to NdFeB magnet corrosion resistance.](image-url)
Bare Magnet Corrosion Test Results
96 Hour Autoclave Test (130°C, 2.7 Bar, Steam)

Material Grade

Weight Loss (mg/cm²)

Typical commercial, 2000
Best in class, 2000
633 AP
655 AP
677 AP
688 AP

25
2.035
0.21
-0.04
-0.04
-0.02
# VACODYM Corrosion Protection

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<td>10 µm</td>
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<td>Humidity Salt spray</td>
<td>210 °C</td>
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</table>
Plating alone is not the answer

Even with electrolytic zinc, these magnets were not able to survive the automotive under-the-hood environment.
With the right magnet and plating...

Supplier X: electrolytic Zn after 130°C/2.7 bar/100% humidity

VACODYM 6xx: electrolytic Ni+Sn after 130°C/2.7 bar/100% humidity