Nickel-Aluminum Composite Powders are a type of exothermic self-bonding thermal-spraying materials. The composite powders include those of Nickel Clad Aluminum, Aluminum Clad Nickel, Nickel Chromium-Aluminum, etc. These powders are characterized by vigorous exothermic reaction occurring between molten aluminum and nickel during the thermal spray application stage. The reaction promotes the formation of metallurgical bond between the applied powder coating and the substrate, hence providing the "self-bonding" coating.

Nickel-Aluminum Composite Powders are commonly used as undercoats. Among them, Nickel Clad Aluminum and Aluminum Clad Nickel Composite Powders can be applied at moderate temperatures forming undercoat easily just by flame spray. Nickel Chromium Aluminum Composite Powder can be used at high temperatures, say above 650°C. Its coating is easily formed by either plasma or flame spray. Nickel-Aluminum Composite Powders can also be applied to form protective coat resistant to oxidation and to thermal shock.
# Nickel-Aluminum Composite Powders

<table>
<thead>
<tr>
<th>POWDER</th>
<th>PARTICLE SIZE (MESH)</th>
<th>TYPICAL COMPOSITION (%)</th>
<th>COATING FUNCTION &amp; APPLICATIONS</th>
</tr>
</thead>
</table>
| TS-1 Nickel-Clad Alumin-um Composite Powder | -140+325 | Al: 9.0  
Impurity < 1.0  
Ni: Balance | * Resistant to wear, oxidation, thermal corrosion and thermal shock at temperature up to 815°C; * Good for aero-engine parts, tank transmission parts, internal combustion engine driving parts, automobile crankshafts, machine tool slide-ways, great-power engine shafts and air blower vanes, etc. |
| TS-2 Nickel-Clad Alumin-um Composite Powder | -140+325 | Al: 17~20  
Impurity < 1.0  
Ni: Balance | * Good for aero-engine parts, tank transmission parts, internal combustion engine driving parts, automobile crankshafts, machine tool slide-ways, great-power engine shafts and air blower vanes, etc. |
| TS-3 Aluminum-Nickel-Aluminum Composite Powder | -140+325 | Al: 13~16  
Impurity < 1.0  
Ni: Balance | * Excellent resistance to high temperature (<980°C) oxidation and to atmosphere corrosion; * Good for exhaust mufflers, heat treatment forges and equipment, exhaust valves, high temperature clearance control, especially as undercoating for ceramics |
| TS-5 Aluminum Clad Nickel Composite Powder | -140+325 | Ni: 85  
Al: 7  
Si, Ti: Balance | * Excellent exothermic self-bonding property; * Resistant to oxidation and thermal shock; * Good as bond layer or service coating |
| TS-6 Aluminum Clad Nickel Composite Powder | -140+325 | Ni: 95  
Al: 5 | * Excellent exothermic self-bonding property; * Resistant to oxidation and thermal shock; * Good as bond layer or service coating |
| TS-110 Nickel-Chromium-Aluminum Powder | -140+325 | Cr: 17~19  
Al: 5.5~6.5  
Ni: Balance | * High bonding strength; * Good as a coating resistant to high temperature and SO₂ corrosion and bond layer for ceramics |
| TS-112 Nickel-Chromium-Aluminum-Cobalt Powder | -140+325 | Al: 6  
Co: 6  
Ni-Cr: Balance | * High bonding strength; * Good as a coating resistant to high temperature and SO₂ corrosion and bond layer for ceramics |
| TS-113 Nickel-Chromium-Aluminum-Cobalt Powder (TS-113) | -140+325 | Cr: 14~16  
Co: 6  
Al: 4.0~5.0  
Y₂O₃: 1.5~2.0  
Others: 4.0~5.0  
Ni: Balance | * High temperature oxidation resistant coating and bonding layer for thermal barrier coatings |
| TS-113F Nickel-Chromium-Aluminum-Cobalt-Yttria Composite Powder (TS-113F) | -140+325 | Cr: 14~16  
Co: 6  
Al: 4.0~5.0  
Y₂O₃: 1.5~2.0  
Others: 4.0~5.0  
Ni: Balance | * High temperature oxidation resistant coating and bonding layer for thermal barrier coatings |
| TS-114 Nickel-Chromium-Aluminum-Yttria Composite Powder | -140+325 | Al: 6  
Y₂O₃: 2  
Ni-Cr: Balance | * High bonding strength; * Good as a coating resistant to high temperature oxidation, SO₂ corrosion and employed as bonding layer for ceramic coatings |