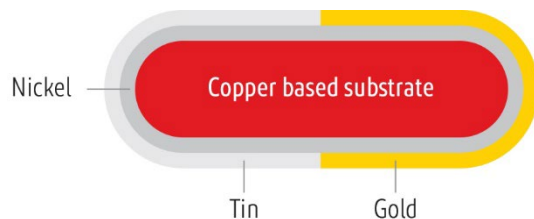


Taking Nickel to a New Performance Level for Electronic Component Applications

Nickel has been used as a barrier layer between the substrate material and the functional surface deposit on electronic components for decades. Electroplated nickel deposits plated onto copper-based substrates provide an effective diffusion barrier, preventing copper from migrating to the surface and causing corrosion, solderability or contact resistance issues.

Nickel plating is ubiquitous in the industry, with the development and performance focus typically on the surface layer, or novel stacks, for enhanced performance or cost benefits.

X-section of typical connector pin plated layers



Next-Generation Nickel

DuPont has developed a new nickel to maintain the essential barrier layer performance while enabling a multitude of new benefits, both in the process operation and the deposit performance. The new process is **Nikal™ BF-100 Nickel**.

Nikal™ BF-100 Nickel Process Performance

All liquid makeup and replenishment

- No more waiting for solids to dissolve before operation, providing higher productivity and reduced energy usage.
- No need to maintain the bath at operating temperature during non-production periods, providing further energy savings.
- No boric acid crystals blocking filters, pipes, or nozzles; reducing downtime and maintenance.

Wider operating window with higher current density capability

- Higher productivity and lower costs.
- Greater part loading and geometry freedom.

Higher throwing power

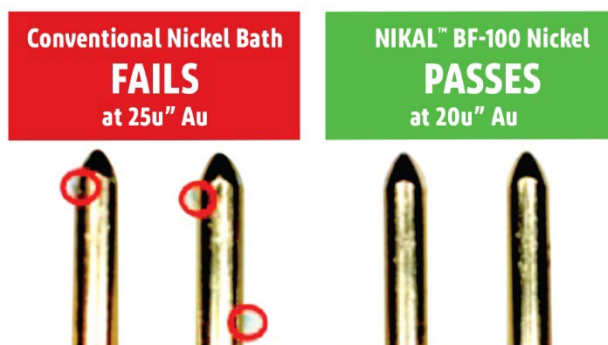
Throwing power is a measure of the plated metal thickness in the lowest current density areas of the part, compared to the average surface area thickness. To achieve the functional protection provided by the nickel layer, all areas must be plated. Therefore, the time to plate the most recessed areas dictates the plating time for the part. Incomplete nickel coverage in recessed areas will result in early corrosion failure.

- Nikal™ BF-100 Nickel demonstrates superior throwing power to conventional nickel under the same plating and part conditions, thus delivering shorter plating time, higher productivity, and lower nickel use to achieve the desired specification.

Nikal™ BF-100 Nickel Deposit Performance

Nikal™ BF-100 Nickel grain structure enables use of about 30% less gold

- This new product is designed to deposit nickel with densely packed crystals with associated low porosity. The subsequent gold layer plated on top of the nickel mirrors this cubic grain and forms a densely packed deposit. This denser gold deposit can withstand corrosive environments for longer at the same thickness, or survive the standard corrosion tests using about 30% lower gold thickness. With gold prices at close to US\$2000 / oz, that's a major cost component of connectors, and therefore a huge cost saving opportunity.



Higher corrosion resistance

- Due to the dense structure, the Nikal™ BF-100 deposit can pass the 2-hour nitric acid vapour test at about 30% lower gold thickness, providing the component with higher corrosion resistance.

Lower deposit stress

- Nickel deposits typically exhibit tensile stress.
- Nikal™ BF-100 Nickel deposit stress levels vary depending on additive and brightness requirements but are at least 50% lower than deposits from a typical sulphamate nickel bath.

Sustainability Gains

While we developed Nikal™ BF-100 Nickel to boost performance and productivity, this innovative solution also supports electronic manufacturers' efforts to improve sustainability.

By helping companies achieve higher productivity, reduce heating time and cut down on maintenance, Nikal™ BF-100 Nickel can help companies reduce power consumption (and CO₂ emissions). Nikal™ BF-100 Nickel offers other important environmental benefits when compared to traditional electrolytic nickel electrolytes:

- This process does not contain boric acid as an intentionally added raw material. The European Chemical Agency identifies boric acid as "Toxic to Reproduction."



<p>Substance Identity</p> <p>EC/List no.: 233-139-2</p> <p>CAS no.: 10043-35-3</p> <p>Mol. formula: BH3O3</p> 	<p>Hazard Classification & Labelling</p>  <p><i>Danger!</i> According to the harmonised classification and labelling (APT17) approved by the European Union, this substance may damage fertility and damage the unborn child.</p> <p>Additionally, the classification provided by companies to ECHA in REACH registrations identifies that this substance may damage fertility or the unborn child.</p>
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- Test data shows that Nikal™ BF-100 Nickel operates at about 20% lower nickel concentration and achieves higher current density, as shown in the table below, reducing costs and consumables further.

	ASD	10	15	20	25	30
Conventional Boric Acid Nickel at 125g/L Nickel	OK	✓	✓	~	✗	✗
NIKAL™ BF-100 Nickel 100g/L Nickel	OK	✓	✓	✓	~	✗

Note that actual current density limits can be higher, depending on solution agitation.

Nickel Plating Taken to a New Level

The Nikal™ BF-100 Nickel provides value on many levels, whether the requirement is improved corrosion resistance, or improved productivity, or using an innovative product designed to not include a toxic substance.

This novel nickel process is now available globally from your DuPont team.