The use of gold layers deposited onto nickel is standard in many industries, from DRAM memory module edge connectors, to electrical test probe contacts, to power semiconductor die metallizations and wirebonding pads.

Gold does not form an oxide; it protects the nickel from oxidation or passivation. A clean nickel surface has very high solderability for most solder types, but its oxide is very difficult to remove with standard flux types. Also, gold dissolves almost instantaneously into most solders during assembly, thus promoting superior wettability.

**What are the differences between gold layers deposited by immersion gold and electroplated gold processes?**

There are five main differences:

**The coating thickness is different.** Immersion gold is a displacement reaction, gold displaces the nickel on the surface, and is self-limiting as the nickel surface is coated with the immersion gold. Common baths cannot produce thicknesses of much more than 10 micro-inches, while with electroplated gold the thickness depends on current and time. The higher current or longer the plating time the thicker the gold coating.

**The structure of the gold deposit layers is different.** Electroplated gold is denser that the naturally porous immersion deposit.

**The hardness is usually different.** Electroplated gold often has other metals introduced into the plating that make the deposit harder.

**Porosity is different.** Immersion deposits have more porosity that electroplated deposits; it is the nature of the plating system.
Deposition composition (purity) varies with additives in the bath. Immersion gold baths contain gold as the only plated metal, while electroplating systems may introduce small amounts of other metals.

What advantage does gold have over silver or other metals?

Gold has good tarnish resistance and solderability after storage because it does not form an oxide or hydroxides, so it is unaffected by temperature and storage conditions that might reduce the shelf-life of the other finishes. It meets requirements for lead-free (Pb-free) assembly while offering a coplanar surface that is both solderable and aluminum-wire and gold-wire bondable.

Gold has good electrical conductivity, and produces a contact surface with low electrical resistance. Electroplated gold is also an excellent etch resist.

Electroplated silver is not widely used in the printed circuit industry. Under certain conditions or electrical potential and humidity, silver will migrate along the surface of the deposit and through the body of insulation to produce low-resistance leakage paths. Alkaline cyanide baths for silver electroplating are highly toxic.

Immersion silver is susceptible to problems if not correctly stored and even packaged. Packaging materials that contain sulfur or allow exposure to air will result in tarnishing of the surface (sulfide, sulfate, and chloride formation). High levels of surface contamination can detrimentally affect solderability.