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Metals Trivia:

- Achilles' shield and leg greaves were made of tin according to the Iliad.
- Bismuth has more in common with water than at first glance. Bismuth expands when it solidifies!
- The Mad Hatter in Alice in Wonderland got his name from the common brain damage caused in the production of felts from animal fur, normally beaver, using mercury.

Vertical centrifugal castings can be shaped on the OD using any of several technologies.

Multi-piece steel dies can be made to use in place of the normal cylindrical dies. With planning and coordination, these can be engineered to disassemble, allowing more complex shapes.

Die material including ceramics, graphite, and sand all allow for various degrees of shaping and tolerance. Graphite molding material can be re-used, in most cases, over a short production run. Sand and ceramic can be used one time only.

Have a Metals problem?
Call Us 1-262-650-7171
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WHY ALL THESE ELEMENTS?

Nickel in Alloy Systems

Nickel is one of Earth's most widely suited metallic materials. It can be used as the major constituent of alloys which extend across the temperature scale, as an alloying addition for alloys which are hardened for service, or used to enhance corrosion resistance. Found in pockets around the world, nickel was traditionally extracted from sulfide ores. More commonly in today's world, it is mined from laterite deposits.

Nickel costs have fluctuated from a low in the mid \$2 range following breakup of the USSR to a high of \$25 per pound during the recent worldwide boom.

In iron-based systems, nickel is added to increase hardenability depth in alloy steels (e.g. 4340). In irons, it can be used to create permanent magnets. In stainless steel alloys, which comprise 65% of the world's usage of nickel, it stabilizes the austenitic structure,

28	
Ni	2 8 16 2
Nickel	
58.6934	

improves toughness, and promotes repassivation in reducing environments. Depending on the nickel concentration in the alloy, nickel can reduce or enhance resistance to stress corrosion cracking. High chromium heat resisting alloys utilize nickel additions to stabilize austenite and enhance carburization resistance. Nickel based alloys, which contain the highest amount of nickel, range from solid solution

strengthened alloys (e.g. Alloy 625, Nickel B, Nickel C, Nickel X, etc.) to more complex age-hardenable alloys (e.g. 718, 738, Rene 41, Rene 77, and others). In the age hardened alloys which are primarily strengthened by gamma prime and gamma double prime precipitation, nickel forms intermetallic particles (Ni₃Al/Ti) that impede dislocation movement within the grains, creating additional elevated temperature strength. In copper based aluminum bronze alloy systems, nickel is added to greatly increase seawater corrosion resistance while simultaneously increasing strength.

LOW TURBULENCE STATIC CASTING

Management of the potential causes of casting defects during the filling of the mold is of critical importance in any OD casting process. Defects caused by oxide inclusions, gas bubbles, and cold lapping can be minimized by control of turbulence during the pouring of castings.

Different casting processes offer different solutions to the potential for filling defects. Centrifugal casting, for example, utilizes high g-forces and thermally chilling dies to promote directional solidification. Low density gasses and oxides are centrifuged to the

bore, where they are removed by machining.

Static casters of shaped parts don't have the option of spinning low density defects out of the finished casting envelope and therefore must avoid inclusions and gas by not creating them in the first place.

A small number of suppliers employ proprietary low turbulence static casting technologies that all but eliminate gas bubble and oxide inclusion through a very gentle introduction of the liquid metal into the mold. This low turbulence technology

incorporates flow path design, pour speed, and temperature control and is critical in avoiding the creation of flow related defects. The result can be very high integrity shaped cast parts for applications that do not allow weld upgrade. Other techniques for reduction of defects— including product design for manufacture, proper gating, alloy selection, chemistry control, and process control— are topics for future Tek Bulletins.