

## Copper contributes to NASA's mission - Deep Impact

On Monday, July 4, 2005, NASA will send the impactor of its Deep Impact probe crashing into the 9P/Tempel 1 comet. With 49% of its mass made of copper, chosen for its solidity and the fact that it reacts slowly with other elements, the impactor is expected to hit the comet at a velocity of 36,700 km/h, leaving a crater of around 25 metres deep and 100 metres across. By studying the impact and the resulting crater, NASA engineers hope to learn more about the composition of comets and about the early formation of our solar system.

### Deep Impact, an extraordinary space mission

Launched on January 12 from the US Air Force base at Cape Canaveral, the Deep Impact probe is made up of a mother ship and an impactor, named Smart, that is designed to crash into the comet in order to examine its interior. The separation took place today. The mother ship will observe the effects of the impact and move closer to the interior of the comet to capture images. Smart, however, has to travel towards the comet at a speed of 10 km per second and hit a target area less than 6 km in diameter, from a distance of 864,000 km - a real technological challenge. To make the crater in Tempel 1, the impactor will deliver 19 Gigajoules of kinetic energy through a combination of its mass (370 kg) and its velocity (~10.2 km/s). Sunlight reflecting off the material ejected by the impact should provide a dramatic brightening that will slowly fade as the debris disperses into space or falls back onto the comet. The impact will be watched by a series of land and space based observatories, in particular the Hubble space telescope. While it will be broadcast on the Internet, the impact will also be visible, through a powerful pair of binoculars or a small telescope, very low on the horizon and at twilight in Northern Europe.

### Cutting edge technology exploits copper's performance

Deep Impact is embarking on a real technological challenge: catching up with a comet, hitting it with a probe, analysing the resulting crater and the material ejected. To successfully complete the mission, Deep Impact uses very high precision equipment, including two high-resolution imaging instruments.

Smart is composed 49% of copper, largely because it allows more reliable measurements to be made. Its atomic structure reacts more slowly than other elements, in particular with the oxygen in the water on the comet. Copper produces therefore relatively few intrusive emission lines in the spectrum of the vaporised material, used to analyse the interior of the comet following impact. Copper is also well known for its unrivalled electrical conductivity amongst non-precious metals, making it one of the key materials for modern communications technology, from computers, to mobile telephones, to satellite links or to highly complex optical equipment.

### The 9P/Tempel 1 comet: the original witness

Discovered in 1867 by Ernst Tempel, the Tempel 1 comet has made many passages through the solar system. Comets are particularly interesting for researchers, with these balls of ice, gas, dust and rock having seen the furthest and coldest parts of the solar system. They travel at an average speed of 40 km/s, and generally have orbits of tens of thousands of years. The exception is when large planets affect their trajectory, pulling them into shorter orbits, as is the case with Tempel 1, which has an orbit of 5.5 years.

### **About the European Copper Institute:**

*The European Copper Institute is a joint venture between the world's mining companies (represented by the International Copper Association, Ltd.) and the European copper industry. Its mission is to promote copper's benefits to modern society across Europe through its Brussels office and its network of eleven Copper Development Associations. [www.eurocopper.org](http://www.eurocopper.org)*

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