Partnership between Bayer MaterialScience and Alcan: Baytubes® carbon nanotubes enhance the properties of aluminum

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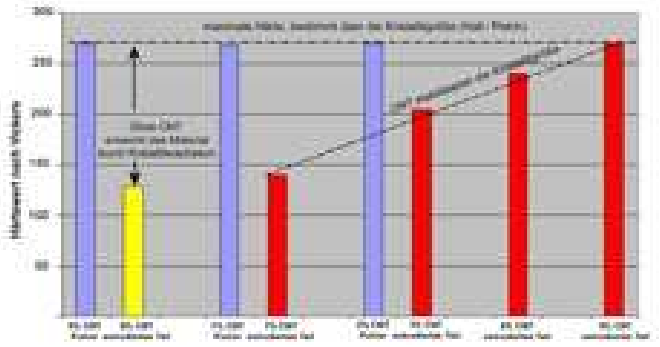

Nearly as strong as steel

The compression and extrusion of aluminum powder hardened through high-energy milling leads to a significant loss in hardness and tensile strength. This effect can be prevented through the addition of Baytubes®. Extruded semi-finished goods made of CNT-reinforced aluminum therefore have similar hardness values to aluminum hardened by high-energy milling.

Abstract:
Used as an additive, Baytubes® carbon nanotubes (CNT) from Bayer MaterialScience AG significantly improve the mechanical properties of powder metallurgy aluminum. For example, the hardness is then several times greater than that of unalloyed aluminum, tensile strengths comparable to those of steel can be achieved, and the impact strength and thermal conductivity of the lightweight metal can be improved significantly. "Together with competent partners in industry, we want to exploit the considerable application potential that arises from this optimization in properties," says Dr. Horst Adams, Vice President of Future Technologies at Bayer MaterialScience, explaining: "We are partnering with Alcan to develop customized, CNT-reinforced aluminum materials."

Based in Montreal (Quebec), Canada, Alcan Inc. is not only one of the world's largest suppliers of raw materials for aluminum manufacturing, it also is a leading producer of this lightweight metal and products made from it. Friction Stir Extrusion is an Alcan proprietary technology to blending and compacting aluminum powders with carbon nanoparticles like CNTs, graphite and graphene.

Until now, high hardness levels and tensile strengths could only be achieved in aluminum by a complex alloying process based on rare and expensive metals. "Our carbon nanotubes are an attractive alternative to such complicated alloys. Baytubes® can also significantly reinforce aluminum materials already alloyed with metals," says Adams.

The density of CNT-reinforced aluminum is only around one third that of steel, and the material can therefore support any number of applications in which the aim is to reduce weight and energy consumption by means of lightweight construction. With its combination of high strength and low weight, it is an alternative to steel, expensive specialty metals such as titanium, and carbon-fiber-reinforced plastics. "This new class of materials has great potential for the production, for example, of screws and other connecting elements, allowing existing manufacturing processes (stamping, CNC) to be retained. Lightweight, heavy-duty components for wheelchairs or athletic equipment are also ideal candidates for the material," says Adams. Promising applications exist too in the automotive and aircraft industries. In addition, Baytubes®-reinforced aluminum I-beams could conceivably be manufactured for the construction industry. Because they are much lighter than steel I-beams, they would make it possible to construct much higher buildings. On account of their inherent weight, steel I-beams currently are a factor limiting the maximum height of a skyscraper.