



Press release

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Tailor-made tool inserts

Manufacturers of tools for injection molding and die-casting are constantly seeking new ways to increase tool life and reduce cycle times for the manufacture of plastic and aluminum components. The demands thus placed on the tools become increasingly complex, and often cannot be realized using conventional, homogeneous materials.

An example is the combination of wear resistance and thermal conductivity. High wear resistance is usually achieved by using high-temperature-strength steels. On the other hand, copper materials provide the best thermal conductivity. The optimum means of combining these two properties is found in gradient materials. These can be designed to offer a variety of properties, such as high wear resistance, high thermal conductivity, toughness and strength, by varying the chemical composition.

The Fraunhofer Institute for Laser Technology ILT in Aachen has qualified two innovative rapid manufacturing techniques for the production of customized tool inserts made of gradient materials, or combinations of materials, for use in toolmaking: laser cladding of blanks with gradient coatings,

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and generative manufacturing of tool inserts made of a combination of materials using selective laser melting (SLM). Both techniques are being presented to a wide specialist audience for the first time at EUROMOLD 2007 in Frankfurt from December 5 to 8, 2007, in Hall 8, Stand L113.

The mold cores in injection molding tools need to be able to dissipate heat from the plastic very quickly, in order to minimize cycle times and guarantee reliable demoldability. Copper is a suitable material for such purposes, but its resistance to wear and corrosion is unsatisfactory for most applications. The Fraunhofer ILT therefore uses laser cladding to coat the mold cores with a graded film on steel basis. The gradient coating provides a degree of wear resistance comparable to that of tool-quality steel.

Gradient materials can also offer significant advantages to manufacturers of die-cast tools. The Fraunhofer ILT has demonstrated the construction of tool inserts with a stainless-steel core covered with a wear- and corrosion-resistant steel alloy applied by means of laser cladding.

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Selective laser melting is employed by the Fraunhofer ILT to manufacture mold inserts with complex tempering channels. By building up the part layer by layer on the basis of CAD data, it is possible to produce any type of complex, hollow structure that cannot be produced using conventional manufacturing techniques. The SLM process developed by the Fraunhofer ILT is capable of processing commercially available metallic production materials in powder form. This enables injection tools to be manufactured directly for series production. The near-net-shape tempering channels enable the tool to cool off rapidly. This not only reduces the manufacturing cycle time but also improves the quality of the plastic products.

The Fraunhofer ILT is now developing an alternative technique in collaboration with the Foundry Institute at RWTH Aachen, in which mold inserts are manufactured from a combination of materials. SLM is used only to built up the hollow shell of the mold insert. The empty space inside it is then filled with a different material by casting. This results in a product where, for example, the outer core is composed of a wear-resistant tool-quality steel, and a highly thermal conductive material such as a copper or aluminum alloy is used as the casting material.

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The advantage: the mold core can be cooled very evenly, thanks to the excellent thermal conductivity of the core, and requires very few cooling channels or none at all, which represents a significant reduction in the time needed for construction.

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