Industrial applications of tool steels made by Spray Forming

by

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Today the production of tool steels via the spray forming route has started to be done commercially. Tools have an important role in most industrial branches and in order to provide materials that allow extending the tool life, the demands on tool steels are permanently increasing. Until recently mainly two technologies have been applied in order to produce highly alloyed tool steels: Electro-slag-remelting (ESR) and Powder-Metallurgy (PM). Today these methods are most frequently used to produce tool steels of very high quality levels, but the gap in properties as well as in prices between these two routes has not until yet been closed.

During the past two decades spray forming has been developed to a technology, which is suitable to produce high alloyed tool steels on an industrial scale. Spray forming allows to widen up the compositional limits of conventionally produced steels and thus closes this gap for the production of high-grade tool steels. It combines the advantages of ESR and PM by producing large, compact billets of best homogeneity and cleanliness.

Since the establishing of Dan Spray A/S in 1998, the company has been working on getting the technology suitable for industrial production. Together with some of the leading tool steel producers today like Uddeholm Tooling AB and Edelstahl Witten Krefeld GmbH Dan Spray has developed new products which today has been released on the market.

Uddeholm Tooling AB research for new opportunities to design cold work tool steels with properties not found in conventional produced cold work tool steels has resulted in development together with Dan Spray 3 new commercial spray formed alloys, ROLTEC, WEARTEC and TOUGHTEC.

ROLTEC and WEARTEC, alloyed with vanadium in order to produce an even distribution of comparatively large and spherical carbides, are aimed for cold work application with higher wear resistance and an excellent hardenability due to the balanced chemical composition of Cr and Mo.

TOUGHTEC is regarded as a steel aimed for plastic and hot work applications in that a higher priority is given to ductility compared to the two other grades, but still with an excellent wear resistance.

Edelstahl Witten-Krefeld GmbH has been cooperating with Dan Spray A/S in order to evaluate the state of art of spray forming and to develop new spray formed tool steels. Encouraged by the positive results of a first study on the spray formed ledeburitic cold-work tool steel X153CrVMo12-1 (Mat.-No. 1.2379; AISI D2) Edelstahl Witten-Krefeld GmbH began to develop new spray formed tool steels:

ESP 23 - a new cold-work tool steel designed to give a well balanced combination of high hardness, wear resistance, and toughness superior to conventionally produced cold-work tool steels.

ESP 32 - a new high-speed tool steel which reveals – due to its chemical composition – an excellent hardening and tempering behaviour with a secondary hardness maximum of 70 HRC. The high carbide content gives the steel an excellent wear resistance and makes the steel suitable for many machining applications.

ESP 45 - designed to combine a high wear resistance with a high corrosion resistance, which makes the steel suitable for applications in the field of plastics processing.

In order to obtain these well balanced combinations of properties it was a most important to optimise the parameters of the forging procedures to the solidification structures of the new spray formed tool steels.

The presentation describes the advantages of using the spray formed tool steels compared to conventional and PM products, and several applications test will be discussed.