Based on the analytical results and the developed design rules, a training session for design engineers including a demonstration of the warm forging process will be performed.

Finally, the results will be documented and published in scientific journals and in SME associations and will be presented at international conferences.

For more information visit:
www.devapro.de

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This project is supported by funding under the 7th Framework Programme of the European Union
Aim of the Project

Against the background of rising market opportunities for high quality warm forged products, in the project DeVaPro – “Development of a Variable warm forging Process” a warm forging process is developed, enabling the forges to produce more complex long flat geometries and thus making the warm forging technology more variable. Warm forging is an economical alternative to the conventional forging technology:

- Reduced energy input
- No scale and reduced decarburization improving the product quality
- Reduced surface roughness
- Closer tolerances

Examples of Long Flat Pieces

Additionally, the replacement of heat-treatable steels by low alloy steels due to improved work piece properties of warm forged products and the potential for light weight design is investigated. To reach those goals, new technologies, namely a warm rolling operation and an induction reheating process are developed and embedded within an established warm forging process chain. The integration of these operations enables the forges to increase the output, improve the final work piece properties and broaden the spectrum of producible geometries.

Process Chain

For two model products the production sequences are developed and tested based on two warm rolling technologies – cross wedge rolling and forge rolling – to evaluate the qualification of both rolling technologies concerning application at lowered temperatures.

Cutting to Length

Heating

Rolling

Intermediate Heating

Forging Operations

Clipping / Punching

Warm Forging Process Chain

A definition of part groups enables SMEs to deduce the possibility of the developed warm forming process chain for other parts of their spectrum. This definition includes distinctive features, to assess the transferability easy and quick.

Rolling of Long Flat Pieces

In addition to FEM-simulations a model test is developed to investigate the process limits of cross wedge rolling of three different materials representing three steel classes. The design of the model test equipment and tools is modular subdivided according to the knifing, guiding, stretching and sizing zone. In the design, the sensors for force and velocity measurement are integrated.

Cross Wedge Rolling Tool

Variable Re-Heating

After the warm rolling operation an intermediate heating is necessary. A main goal for heating for forging is to reach a certain constant temperature throughout the work piece within a minimum time and a maximum of efficiency. The heating line can be adapted very flexible to different work piece diameters and production rates. The whole heating process is controlled by special design software and digital controllers.

Induction Heating in operation