*ABSTRACT*

**Production of large forged parts (steels, stainless steels and nickel based superalloys)**

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Large forged parts are mostly used in oil and gas industry, energy plants and ship industry. Some examples include: hollow bars, tubing and pipes, seamless rolled rings, flanged connectors, valves, turbine rotors, large shafts. The production route of these components is made of different steps consisting of: ingot production, ingot hot deformation by open die forging and/or by rolling, machining and heat treatment. All these steps are critical to guarantee the final quality of forged parts and have to be carefully designed especially considering the alloy composition, the component size and shape and the final mechanical properties requirements.

This presentation describes some case studies faced by the Brescia Metallurgy Group in collaboration with steelmakers and forging industry in the last years. The studies are based on experimental analyses and numerical simulations by finite elements modelling. In particular, the discussed topics are:

* numerical simulation of ingot bottom pouring to forecast the internal cleanness of 42CrMo4 steel heavy forgings,
* the effect of macrosegregation and residual solidification microstructure on the mechanical properties of alloyed steels forged parts,
* the forging cycle optimization to avoid the microstructural abnormal grain growth (AGG) in AISI 316L stainless steels forged bars,
* non-conventional application of precipitation hardening heat treatment on UNS N06625 nickel-based superalloy forged bars for oil and gas field applications.