Military Technical College
Kobry El-Kobbah,
Cairo, Egypt.

17th International Conference on Applied Mechanics and Mechanical Engineering.

USING NEUTRONS AND X-RAY BEAMS IN MODERN METALLURGY

J.-M. Drezet[1, *]

ABSTRACT

The computation of stress development in casting, welding or quenching of metals has been the scope of several studies since the late 90's and is a well established technique nowadays. The validation of these models was often done by comparing the computed and measured part distortions but validation against the computed room-temperature residual stresses was limited simply owing to the difficulty of measuring the internal strains and the high variability in the measurements. In contrast to destructive methods for measuring residual stresses (hole-drilling strain gage, cut compliance, layer removal technique), physical methods such as neutron, X-ray or ultra-sound diffraction, are very attractive since they can yield all stress components. In addition, measurements can be carried out deep within a sample up to the energy limit of the beam. With the development of powerful neutron and X-ray beams, it is now possible to measure the residual strains rather deep in light metal alloys such as aluminum and magnesium since these metals are relatively transparent to neutrons and X-rays as opposed to copper and iron. Examples of post mortem residual stress measurements are given in castings such as round billets and rolling sheet ingots and in as-quenched aluminum thick plates and forgings. Then in situ X-ray and neutron diffraction measurements during the solidification of alloys to study hot cracking are presented.

---

[1] Swiss Federal Institute of Technology in Lausanne, LSMX, station 12, CH-1015 Lausanne, Switzerland.

* Corresponding author: jean-marie.drezet@epfl.ch.