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## Study of the austenitization process in a P91 steel

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In this contribution we address the behavior of precipitated second phases during the first minutes of holding in the austenite phase field for an ASTM A335 P91 steel.

It is well known that two main families of precipitated particles are present in this steel after a standard manufacturing process that includes, as final stages, normalizing and tempering, i.e., M<sub>23</sub>C<sub>6</sub> carbides (M = Cr, Fe, Mo) and MX carbonitrides (M = V, Nb, Cr). In addition, some extra, very low volume fraction phases could be present as a result of tiny variations of the chemical composition within the specified ranges.

The austenitizing thermal cycles were carried out in a high resolution dilatometer Bähr DIL 805 A. The heating rate was fixed at a value of 50 °C/s up to the austenite holding temperature (1050 °C) and austenite holding time was varied between 0 and 5 minutes in steps of 1 minute. After that, samples were quenched using an Ar jet at 50 °C/s.

The precipitated phases were characterized by high-resolution field emission gun scanning electron microscopy and transmission electron microscopy. For each austenite holding time, the sizes of approximately one thousand particles were measured using carbon replicas; the chemical composition was also determined for a selected subset of particles by energy-dispersive X-ray spectroscopy. The histograms of the size number frequency were analyzed in each case and statistical parameters were extracted from the corresponding size distributions.

The experimental results indicate a rapid dissolution of the M<sub>23</sub>C<sub>6</sub> major carbidic phase and a progressive enrichment in Nb of the MX phase in the specified interval of time. Some suggested trends in the size distribution behavior of the remaining particles are also presented.

### Country/Int. Organization

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