

Effect of heat treatment temperature on the structural evolution of hot forged steel balls used for grinding raw material in cement industry

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Abstract : The raw material preparation sector such as cementworks, the steel and mining sector is beginning to pay attention to forged balls as an alternative to the cast balls for their best use characteristics. The forging materials are stronger than the casting material because of their fiber structure. The forging technique, in contrast to the casting process, contributes to a significant improvement of ball wear behavior during the grinding process. The wear behavior depends on several factors including the chemical composition of the alloy, the type of microstructure and the applied heat treatment. In this work we focus on the effect of austenitizing temperature on the type of the produced microstructure. All the heat treatment parameters were fixed for all the samples except the austenitizing temperature. Three austenitizing temperatures are selected and a tempering at 250°C with a holding time of one hour followed by cooling has been carried out. The study is carried out on medium micro-alloyed carbon steel intended for heat treatment. To make clear the effect of the temperature on the microstructural transformation, several investigations were achieved. Optical and SEM microscopy was carried out to qualitatively characterize the phases. A microstructural analysis using the Rietveld method was conducted to access, for each temperature, the type and proportion of phases as well as the crystallites size.

Keywords : grinding balls, forging, heat treatment, characterization, XRD analysis, Rietveld refinement