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**The effect of non-metallic inclusions on the mechanical properties of 32 CDV 13 steel
and their mechanical stress analysis by numerical simulation**

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Abstract

The effect of non-metallic inclusions was established on the mechanical properties and fracture behavior of the 32 CDV 13 steel. Three 32 CDV 13 steels with the same chemical composition and microstructure but different non-metallic inclusions content were characterized. A fractography analysis of the Charpy impact specimens shows that the toughness was increased for the steel with the lowest non-metallic inclusion level. It was observed a localized micro-cracking by the growth of the inclusion-nucleated voids and then connected regions along the crack tip for the steels evaluated. The significant difference in the inclusion level between the steels directly impacts in the formation of flat fracture and percentage shear fracture and therefore in the toughness capacity. The morphology of the different type of inclusions was determined by SEM images, then the stress field distribution around the inclusion according to the inclusion type, shape and distributions were analyzed numerically using the software COMSOL Multiphysics. Numerical simulations show that the geometry of the inclusions influences strongly the concentration of stresses between the inclusion and the surrounding matrix. The non-metallic inclusions presented in the three steels

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