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TOWARDS THE COMPREHENSION OF THE STACKING FAULT ENERGY IN FE-MN-AL-C STEELS

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High manganese steels have been extensively studied in recent decades thanks to their astonishing mechanical properties. In particular, high manganese Fe-Mn-Al-C alloys feature an excellent combination of strength and ductility, properties that depend on the main deformation mechanism and therefore are determined by the stacking fault energy (SFE). To achieve a better understanding of the deformation mechanisms in this system, it is appealing to study the effect of the chemical composition as well as of temperature on the SFE from a microscopic perspective, which allows covering the most important features involved in this phenomenon. Recently, some insights regarding the TWIP phenomenon has been obtained by means of molecular dynamics simulations for a particular composition. In this work, we performed molecular dynamics simulations to systematically analyze the effects of the chemical composition on the SFE of austenitic FeMn alloys. Our simulations are based on MEAM interatomic interaction potentials which have been proved to accurately reproduce fundamental structural and thermodynamic properties of Fe-Mn and Fe-Al binary systems. The obtained energy-displacements curves (i.e., generalized stacking fault curves) provide rich and useful information to comprehend the deformation mechanisms as well as being adopted in the classical thermodynamic treatment of the SFE, and therefore they define an important starting step towards the comprehension of the behavior of the SFE for more complex Fe-Mn-Al-C alloys.

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