Universität des Saarlandes, Postfach 15 11 50, 66041 Saarbrücken

Announcement: Master thesis

"Study of the effect of Ni content in the carbide precipitation during heat treatments"

Lehrstuhl für Funktionswerkstoffe

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Saarbrücken, den 16.09.2018

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The development of high strength low alloy steels (HSLA) has the challenge of increase strength without loss of toughness. Low and medium carbon steels with a tempered martensitic microstructure including retained austenite and transition carbides has been proposed as an option to achieve this combined properties. The chemical composition, and tempering parameters (temperature and time) have a key role in the type, size and distribution of carbides as well as in the block size of martensite and amount of retained austenite. The addition of Ni has generated particular interest, since it stabilizes the austenite, increases the hardenability and decreases the ductile to brittle transition temperature (DTTB). However, the effect of Ni on toughness show not clear tendency and thus, it is still a topic of discussion within the community. Some proposed mechanisms relate the variation of Ni content with the change in the precipitation of carbides during tempering. Nevertheless, further investigations are needed in order to explain this phenomena.

It has been observed that increasing Ni from 0.35 to 4 wt. % in steels tempered at 200 °C generated an evolution from uniformly distributed ε carbides to cementite precipitation in prior austenitic grain boundaries, showing a low number of nucleation sites and larger carbide size as Ni content increases. In this context, is still necessary a systematic characterization of the microstructure evolution for different tempering temperatures in dependence of the Ni content. The aim of this work is to evaluate the influence of Ni in the carbide precipitation when tempering temperature varies.

The study includes carry out the thermal treatment, microstructure characterization by light optical microscopy and scanning electron microscopy, and carbide characterization by replica technique and STEM.

Requirements:

-Basics in steel microstructures
-Basics in microstructural characterization.
-Understanding of thermal treatment of steels.
-Fluent in English (The thesis should be write in English).

Duration: 3/6 Monate
Start: flexibel
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