

# **Komitet za termodinamiku i fazne dijagrame Srbije**

*u saradnji sa:*

Fakultetom tehničkih nauka u Kosovskoj Mitrovici,

Tehničkim fakultetom u Boru i

Associated Phase Diagram and Thermodynamics Committee  
(Poland, Czech Republic, Hungary, Bulgaria, Slovenia, Serbia,  
Montenegro, Romania, Croatia, Bosnia and Herzegovina)

## **DVANAESTI SIMPOZIJUM O TERMODINAMICI I FAZNIM DIJAGRAMIMA**

*sa međunarodnim učešćem*



## **ZBORNİK IZVODA RADOVA**

**Kosovska Mitrovica,  
20-21. jun 2025. god.**

# Dvanaesti simpozijum o termodinamici i faznim dijagramima

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## **The influence of vanadium on the microstructure and electrochemical properties of carbides in chromium-molybdenum steels**

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### **Abstract**

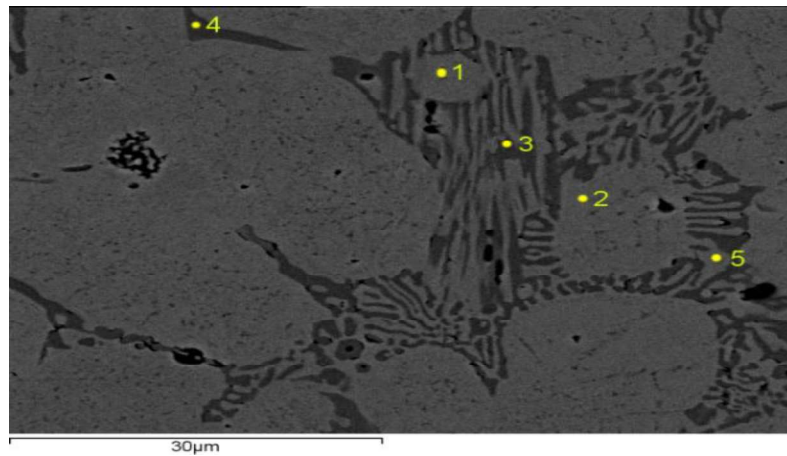
Besides the modern non-metallic materials, which can successfully replace metallic materials in certain fields, steel materials are still largely present in technical practice. That trend will remain for many years to come. That is why there is a need to develop new types of steel, that possess better properties, in addition to the existing ones. The Cr-Mo steels, with a high vanadium content, belong to a group of the newer steels, with relatively high values of hardness and toughness. The X180CrMo12-1 steel, with varying percentages of vanadium, within the limits of 0.5-3 %, was used for the tests in this work. Vanadium, as a carbide-forming alloying element, creates a carbide network of the  $M_7C_3$  type around the metal substrate, and finely dispersed carbides of the  $V_6C_5$  type within the metal substrate. For the conducted research, modern equipment was used for analysis of the chemical composition, monitoring of the shape of metal grains and carbide network, as well as for electrochemical characterization. In the conducted research, the objective was to determine the carbide composition, microstructure, and morphology and to evaluate their impact on the material's characteristics. The steel samples were experimentally examined using scanning electron microscopy with energy dispersive spectrometry (SEM-EDS) and X-ray diffractometric analysis (XRD). The carbide composition analysis has confirmed that this actually was the  $M_7C_3$  carbide, as it was earlier assumed.

**Type of work:** original research paper.

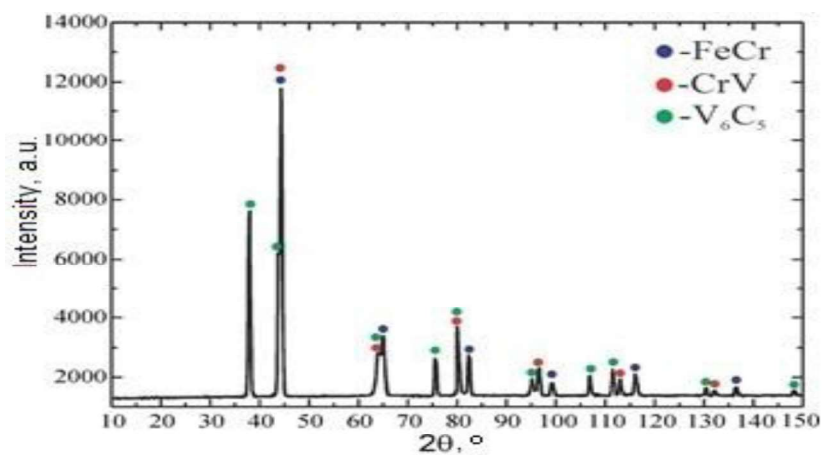
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2. C. Capdevila, C. Garcia-Mateo, J. Chao, F.G. Caballero, *Materials Science and Technology*, 25(11) (2009), 1383-1386.

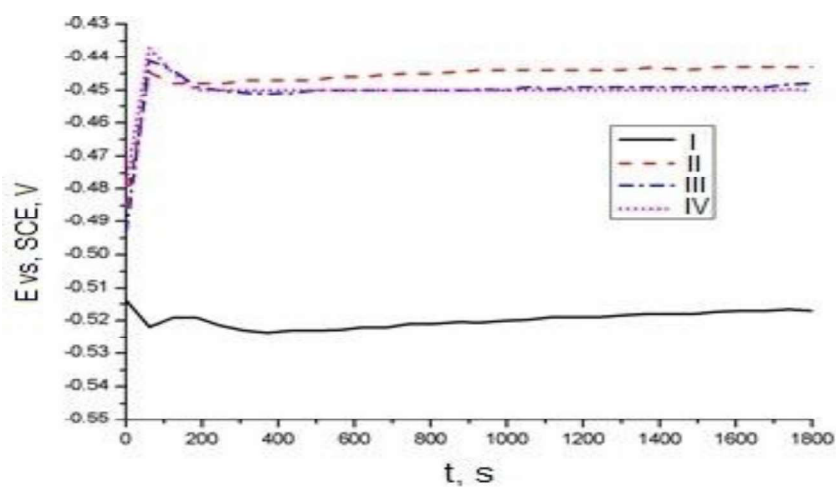
Graphical abstract:



Microstructure of alloy sample I.



Diffractogram for tested sample IV.



Open circuit potential for samples I, II, III, IV in 0,1 M  $H_2SO_4$ .



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