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*Udruženje Inženjera Srbije za Koroziju i Zaštitu Materijala*



**INSTITUTE OF CHEMISTRY, TECHNOLOGY AND METALLURGY,  
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## **Influence of Parameters and Regimes of the Electrodeposition on Morphology and Structure of Tin Dendrites**

### **Uticaj parametra i režima elektrohemijskog taloženja na morfologiju i strukturu dendrita kalaja**

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#### **Abstract**

Tin dendrites were synthesized via electrochemical route from the alkaline electrolyte applying both potentiostatic and galvanostatic regimes of the electrodeposition. Various both cathodic potentials and amounts of the passed electricity were used for Sn electrodeposition in the potentiostatic regime. Morphology and structure of synthesized tin dendritic particles were characterized by scanning electron microscopy (SEM) and X-ray diffraction (XRD) techniques, respectively. Depending on the applied cathodic potential, morphology of tin dendrites changed from the needle-like and the spear-like to very ramified dendrites of various shape. The branchy Sn dendrites were of two dimensional (2D) shape constructed from stalk and branches developed from it (primary (P) branches), classifying them into 2D(P) type according to Wranglen's definition of a dendrite. The XRD analysis of produced tin particles showed that the needle-like and the spear-like dendrites represented monocrystals (200) orientation, while Sn crystallites in the potentiostatically obtained 2D(P) dendrites were predominately oriented in (440) plane. Morphology of tin particles was also correlated with polarization characteristics for this system, confirming belonging tin to the group of the normal metals, characterized by the high values of the exchange current density and overpotential for hydrogen evolution reaction, and by the low melting point.

**Keywords:** tin; electrodeposition; morphology; structure; dendrite.

#### **Izvod**

Dendriti kalaja su bili sintetizovani elektrohemijskim putem iz alkalnog elektrolita primenjujući i potenciostatski i galvanostatski režim elektrohemijskog taloženja. Elektrohemijsko taloženje kalaja u potenciostatskom režimu je vršeno na različitim katodnim potencijalima i sa različitim količinama naelektrisanja. Morfologija i struktura sintetizovanih dendritičnih čestica kalaja su okarakterisane tehnikom skenirajuće elektronske mikroskopije (SEM) i rentgensko difrakcionom analizom. U zavisnosti od primenjenog katodnog potencijala, morfologija dendrita kalaja se menjala od igličastih i dendrita nalik koplju do veoma razgranatih dendrita. Veoma razgranati kalajni dendriti su bili dvodimenzionalnog (2D) oblika izgrađeni od stabla i grana razvijenih iz stabla (primarne (P) grane), klasifikujući ih u 2D(P) tip prema Vranglenovoj definiciji dendrita. Rentgensko-difrakciona analiza je pokazala da igličasti i dendriti nalik koplju su predstavljali monokristale (200) orijentacije, dok su kristaliti kalaja u potenciostatski dobijenim 2D(P) dendritima bili dominantno orijentisani u (440) ravni. Morfologija čestica kalaja je bila takođe korelisana sa polarizacionim karakteristikama za ovaj sistem, potvrđujući pripadnost kalaja grupi normalnih metala okarakterisanih visokim vrednostima gustine struje izmene i prenapetosti za reakciju izdvajanja vodonika, i niskom tačkom topljenja.

**Gljučne reči:** kalaj; elektrohemijsko taloženje; morfologija; struktura; dendrit.