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“Surface morphology of 316L stainless steel electrochemically polished in DES liquids as green solvents”

The aim of the doctoral dissertation was the selection of a eutectic solvent (Deep Eutectic Solvent, DES) as an alternative galvanic bath that can be used in the process of electrochemical polishing of AISI 300 series alloy steels. For this purpose, it was necessary to determine the relationship between the conditions of the process, the composition of the solvent, and the following parameters of the modified surface: microstructure and surface topography, corrosion resistance, surface roughness and its gloss. A number of research processes were used for this purpose, in which the current parameters of steel samples in deep eutectic solvent were initially evaluated using, i.e., linear sweep voltammetry (LSV). Then, the parameters at which the anodic polarization process was conducted were determined, which was to confirm the possibility of conducting the electrochemical polishing process in the selected solvent. The obtained samples were examined in terms of surface morphology and topography, before and after the polarization process. Scanning electron microscopy (SEM) and contact profilometry were used for this purpose. An analysis of the surface gloss was also carried out. The next step was to analyze the chemical composition of the obtained solvents and steel samples before and after the polarization process using atomic emission spectrometry (AES-ICP) and X-ray photoelectron spectroscopy (XPS). Finally, the corrosion resistance of steel was assessed using linear polarization resistance (LPR) method. As a result of the conducted research, it was possible to determine that in a deep eutectic solvent composed of choline chloride and propylene glycol, the process of anodic polarization of AISI 316L austenitic stainless steel can be carried out, which corresponds to most of the assumed aspects of the electrochemical polishing process. As a result of the anodic polarization process, it was possible to reduce surface micro-roughness, increase gloss, and increase the corrosion resistance of the tested steel.