

Pengaruh perlakuan panas terhadap perubahan struktur kristal dan sifat korosi paduan Co-Cr-Mo-Al dalam larutan simulated body fluid (SBF) = Influence of heat treatment on crystal structure and corrosion properties of Co-Cr-Mo-Al alloy in simulated body fluid (SBF) solution

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Abstrak

Salah satu sifat biokompatibilitas paduan kobalt sebagai biomaterial adalah ketahanan korosi paduan terhadap lingkungan biologis seperti Simulated Body Fluid (SBF). Paduan kobalt memiliki dua struktur kristal dominan yaitu struktur FCC dan HCP. Paduan Co-Cr-Mo-Al mengalami perlakuan panas pada suhu 1000 °C, dengan variasi waktu penahanan selama 4, 6 dan 8 jam. Pengamatan struktur kristal paduan dengan menggunakan difraksi sinar-x dan pengamatan korosi menggunakan metode voltametri siklik (CV) dan voltametri linear (LSV) dalam larutan SBF pada suhu cairan simulasi SBF 20, 32 dan 37 °C. Dari pola difraksi sinar-X, diketahui bahwa perlakuan panas meningkatkan ukuran kristal paduan dan menurunkan parameter kisi kristal struktur FCC sebesar 0,041 Å dibandingkan sampel tanpa pemanasan. Pengamatan voltametri siklik menunjukkan bahwa reaksi reduksi-oksidasi berlangsung secara searah (irreversible) dan pembentukan lapisan pasif terjadi secara spontan di lingkungan SBF. Data LSV digunakan untuk menentukan tingkat korosi paduan. Tingkat korosi yang rendah ditemukan pada paduan yang tidak diberi perlakuan panas pada temperatur pengujian 37°C sebesar 8,843 mm/tahun. Dapat disimpulkan bahwa perlakuan panas dengan waktu penahanan yang berbeda mempengaruhi struktur kristal dan sifat korosi paduan Co-Cr-Mo-Al dalam larutan SBF.

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One of the biocompatibility properties of cobalt alloys as a biomaterial is the corrosion resistance of the alloy to the biological environments such as Simulated Body Fluid (SBF). Cobalt alloys have two dominant crystal structures namely the FCC and HCP structures. The Co-Cr-Mo-Al alloy were subjected to heat treatment at a temperature of 1000 °C, with variations in holding time for 4, 6, and 8 hours. Observation of the crystal structure of the alloy by using x-ray diffraction and corrosion observation using the voltammetry method Cyclic Voltammetry (CV) and Linear Sweep Voltammetry (LSV) in Simulated Body Fluid (SBF) at a temperature of 20, 32 and 37 °C. From the X-ray diffraction pattern, it is known that heat treatment increases the alloy crystal size and decreases the crystal lattice parameters of the FCC structure by 0.041 Å compared to samples unheated. Observation of cyclic voltammetry shows that the reduction-oxidation is irreversible and the formation of passive layers occurs spontaneously in the SBF environment. LSV data are used to determine the rate of corrosion of the alloy. A low level of corrosion was found in alloys that were not unheated at a test temperature of 37 °C of 8.843 mm/year. It can be concluded that heat treatment with different holding time affects the crystal structure and corrosion properties of Co-Cr-Mo-Al alloys in the SBF solution.