Pengaruh metode pencelupan terhadap transformasi fasa dan kekerasan paduan Cu-25,9Al-3,6Mn (at. %) untuk aplikasi paduan ingat bentuk = Effect of quenching method on phase transformation and hardness of Cu-25.9Al-3.6Mn (at. %) application in shape memory alloy

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Abstrak

Paduan ingat bentuk merupakan salah satu material cerdas dengan kemampuan kembali ke bentuk semula setelah diberi perlakuan panas. Paduan berbasis Cu merupakan salah satu material yang bisa digunakan sebagai alternaltif dari paduan Ni-Ti yang telah umum digunakan, memiliki sifat ingat bentuk yang baik dan biayanya yang terjangkau. Pada penelitian ini dipelajari pengaruh metode pencelupan terhadap struktur mikro dan kekerasan paduan Cu-25,9Al-3,6Mn (at. %). Sampel dibuat dengan metode pengecoran gravitasi, kemudian dihomogenisasi pada temperatur 900 °C selama 2 jam dan didinginkan pada temperatur ruang. Selanjutnya dilakukan perlakuan panas betatizing pada temperatur 900 °C selama 30 menit dan dilanjutkan dengan tiga metode pencelupan, yaitu Pencelupan Langsung (Direct Quench/DQ), Pencelupan Naik (Step Quench/SQ) dan Pencelupan Bertahap (Step Quench/SQ). Tahapan karakterisasi dilakukan menggunakan Optical Microscope (OM), Scanning Electron Microscope-Energy Dispersive Xray Spectroscopy (SEM-EDS), X-ray Diffraction (XRD), Differential Scanning Calorimetry (DSC), strain recovery test, dan Microvickers. Hasil penelitian menunjukkan bahwa struktur mikro paduan as-cast dan as- homogenized terdiri atas matriks fasa dan fasa kedua dengan morfologi rosette-like di dalam matriks dan batas butir. Hasil pencelupan DQ dan UQ menghasilkan fasa martensit berupa garis tipis dan fasa , sedangkan pencelupan SQ memiliki fasa martensit berupa garis tipis, fasa , dan fasa sisa akibat laju pendinginan yang lambat. Untuk nilai kekerasan paduan adalah 293,2 HV (as-cast), 311,3 HV (as-homogenized), 286,7 HV (DQ), 287,1 HV (UQ) dan 283,5 HV (SQ). Strain recovery tidak dapat diukur karena sampel mengalami perpatahan saat ditekuk.

.....Shape memory alloy is one of the smart materials that have capability to remember their original shape after deformation followed by heating at certain temperature. Cu-based alloys can be used as an alterlative to the commonly used Ni-Ti alloys, has good shape memory properties and is affordable. In the research, the effect of quenching method on microstructure and hardness of Cu-25.9Al-3.6Mn (at. %) alloy was studied. The alloy was prepared by gravity casting and homogenized at 900 °C for 2 hours followed by cooling at room temperature. Furthermore, betatizing was carried out at 900 °C for 30 minutes and followed by three quenching methods, Direct Quench (DQ), Up Quench (UQ) and Step Quench (SQ). The Characterization was conducted by Optical Microscope (OM) Scanning Electron Microscopy -Energy Dispersive Xray Spectroscopy (SEM-EDS), X-Ray Diffraction (XRD), Differential Scanning Calorimetry (DSC), strain recovery test, and microvickers. The results of observations of the as-cast and as-homogenized microstructure alloys consist of a phase matrix and a phase precipitate with rosette-like morphology in the matrix and grain boundaries. DQ and UQ quenching results have martensite phase in the form of thin lines and retained phase, while SQ quenching has martensite phase in the form of thin lines, retain phase, and retain phase appears due to slow cooling rate. The alloy hardness values are 293.2 HV (as-cast), 311.3 HV (as-homogenized), 286.7 HV (DQ), 287.1 HV (UQ) and 283.5 HV (SQ) respectively. Strain recovery could

not be measured from the samples because the samples fracture when bent.