

Pengaruh penambahan Cr terhadap respon pengerasan penuaan paduan Al-10Zn-6Mg-xCr hasil squeeze casting = Effect of Cr addition on the age hardening response of Al-10Zn6Mg-xCr produced by squeeze casting

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Abstrak

[Stainless steel merupakan material yang paling banyak digunakan dalam pembuatan turbin pembangkit tenaga listrik Organic Rankine Cycle (ORC), karena densitasnya yang tinggi, membuat kinerja turbin menjadi kurang efisien. Salah satu alternatif penggantinya adalah paduan aluminium seri 7xx.x (Al-Zn-Mg) yang memiliki sifat mekanik terbaik dibandingkan dengan seri yang lainnya. Sifat mekanik paduan tersebut dapat ditingkatkan dengan penambahan Cr serta perlakuan pengerasan penuaan. Pada penelitian ini dipelajari pengaruh penambahan Cr sebesar 0, 0.03, 0.1 dan 0.46 wt. % pada paduan Al-10Zn-6Mg. Paduan dibuat dengan proses squeeze casting dengan tekanan sebesar 76 MPa. Pelat selanjutnya dihomogenisasi pada temperatur 400 oC selama 4 jam dan dilakukan proses pengerasan penuaan dengan melakukan solution treatment pada temperatur 440 oC selama 2 jam, pendinginan cepat, dan penuaan pada temperatur 130 oC. Karakterisasi yang dilakukan diantaranya adalah pengujian kekerasan Rockwell B, pengujian impak, pengamatan struktur mikro dengan mikroskop optik dan Scanning Electron Microscope (SEM) dilengkapi dengan Energy Dispersive X-Rays (EDX), dan Simultaneous Thermal Analysis (STA). Hasil penelitian menunjukkan bahwa penambahan Cr sebesar 0.03, 0.1 dan 0.46 wt. % meningkatkan kekerasan paduan Al-10Zn-6Mg menjadi 50.9, 52.8, 53.2 HRB yang diakibatkan oleh pengecilan ukuran SDAS, pembentukan larutan padar Cr di dalam matriks serta pembentukan fasa kedua (CrFe)Al₇ dan CrAl₇ pada penambahan 0.46 wt. % Cr. Penambahan Cr belum memberikan pengaruh yang signifikan terhadap proses pemanasan.Stainless steel is most widely used in manufacturing of turbine impeller of Organic Rankine Cycle (ORC). However, due to its high density, the performance of turbine becomes less efficient. One alternative to substitute stainless steel is 7xx.x series aluminum alloys (Al-Zn-Mg) which have good mechanical properties compared to other series. Their mechanical properties can be improved by the addition of Cr as well as precipitation hardening process. This research studied the effect of addition of Cr with variation of 0, 0.03, 0.1 and 0.46 wt. % in Al-10Zn-6Mg alloys. The samples were made by squeeze casting process with pressure of 76 MPa. The plate was then homogenized at 400 ° C for 4 hours, followed by precipitation hardening process which consisted of solution treatment at 440 ° C for 2 hours, water quenching and ageing 130 ° C. Characterization was done by Rockwell B hardness testing, impact testing, microstructure observation by using optical microscope and Scanning Electron Microscope (SEM) equipped with Energy Dispersive X-rays (EDX) and Simultaneous Thermal Analysis (STA). The results showed that addition of Cr 0.03, 0.1 and 0.46 wt. % increase the hardness of Al-10Zn-6Mg alloys to 50.9, 52.8, 53.2 HRB respectively, which were due to reduction of SDAS, solid solution strengthening of Cr in the matrix and the formation of (CrFe)Al₇ and CrAl₇ second phases when 0.46 wt. % Cr was added. During ageing process also increased hardness alloys, but Cr were not have a significant impact on the transformation phase. The addition of Cr not have a significant influence on the heating process. ;Stainless steel is most widely used in manufacturing of turbine impeller of Organic Rankine Cycle (ORC).

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