Pengaruh penambahan ti terhadap respon pengerasan penuaan paduan al 10zn 6mg xti hasil squeeze casting = Effect of ti addition on the age hardening response of al 10zn 6mg xti alloys produced by squeeze casting

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Abstrak

Aluminium dan paduannya tengah dikembangkan sebagai sudu turbin Organic Rankine Cycle (ORC) dalam sistem pembangkit listrik karena sifatnya yang ringan, mudah dibentuk dan tahan korosi. Paduan aluminium 7XXX yang mengandung Zn dan Mg dapat ditingkatkan sifat mekanisnya melalui proses pengerasan penuaan. Penambahan Ti dapat semakin meningkatkan kekerasan melalui mekanisme penguatan batas butir.

Penelitian ini bertujuan untuk mengetahui pengaruh penambahan 0, 0.02, 0.05 dan 0.25 wt.% Ti dalam paduan Al-10Zn-6Mg. Pembuatan paduan dilakukan dengan proses squeeze casting. Proses homogenisasi dilakukan pada pada temperatur 400 °C selama 4 jam. Peningkatan kekerasan dilakukan dengan pengerasan pengendapan yaitu laku pelarutan pada temperatur 440 °C selama 4 jam, pencelupan cepat dan penuaan pada temperatur 130 °C selama 200 jam. Karakterisasi meliputi pengujian kekerasan untuk mengamati respon pengerasan penuaan dengan Rockwell B, pengujian impak, pengamatan struktur mikro dan pengujian Simultaneous Thermal Analysis (STA). Struktur mikro diamati menggunakan mikroskop optik dan Scanning Electron Microscope (SEM) yang dilengkapi dengan Energy Dispersive Spectroscopy (EDS).

Hasil penelitian menunjukkan bahwa penambahan Ti sebesar 0, 0.02, 0.05 dan 0.25 wt.% Ti meningkatkan kekerasan as-cast sebesar 49.72, 49.92, 52.02 dan 53.08 HRB akibat pengecilan secondary dendrite arm spacing (SDAS) menjadi 22.78, 22.69, 19.56 dan 16.55µm. Penuaan pada temperatur 130 ºC meningkatkan kekerasan, namun penambahan Ti tidak menunjukkan pengaruh signifikan terhadap kekerasan puncak dan harga impak. Fasa kedua yang terbentuk selama proses solidifikasi adalah T (Mg32(Al,Zn)49, β (Al8Mg5) dan TiAl3 sementara penuaan menghasilkan endapan GP Zone, ƞ? dan ƞ (MgZn2). <hr>Aluminum alloys are being developed as turbin impeller of Organic Rankine Cycle (ORC) in power plant generation system, due to lightweight, formable and corrosion resistant. Al 7xxx series with Zn and Mg alloying elements are one options because of increase the mechanical properties in high temperatures due to age hardening. Ti as grain refiner was added to further improve hardness through grain boundary strengtening mechanism.

This research aimed to find out the effects of 0, 0.02, 0.05 and 0.25 wt.% Ti addition in the Al-10Zn-6Mg alloys. The alloys were produced by squeeze casting process. Homogenization was conducted at 400°C for 4 hour followed by solution treatment at 440 °C for 1 hour, quenching and ageing at 130 °C for 200 hour. Age hardening response was followed by Rockwell B hardness testing. Other characterization included impact testing, Simultaneous Thermal Analysis (STA) and microstructural analysis by using optical microscopy and Scanning Electron Microscope (SEM) with EnergyDispersive X-ray (EDX).

The result showed that addition of 0, 0.02, 0.05 and 0.25 wt.% Ti increased the as-cast hardness of Al-10Zn-6Mg to 49.72, 49.92, 52.02 and 53.08 HRB due to decreasing of secondary dendrite arm spacing (SDAS) to 22.78, 22.69, 19.56 and 16.55µm, respectively. Ageing at 130 ºC increased the hardness of the alloys, but addition of Ti did not affect the peak hardness and the impact values. The second phases formed during solidification were found to be T (Mg32(Al,Zn)49, β (Al8Mg5) dan TiAl3, while the precipitates formed during ageing were GP Zone, ƞ? and ƞ (MgZn2).