Peran 1 dan 9 wt. % Zn dalam proses pengerasan presipitasi paduan aluminium AA319 = The Role of 1 and 9 wt.% Zn in precipitation hardening of AA319 aluminium

Bondan Tiara Sofyan, author

Abstrak

Paduan aluminium banyak dipakai pada aplikasi otomotif, karena berat jenisnya yang rendah dan ketahanan korosinya yang baik. Karena alasan ekonomis, proses pengecoran produk otomotif selalu memakai scrap dalam komposisi yang cukup besar, yang mengakibatkan fluktuasi kandungan unsur paduan, seperti antara lain Zn. Studi ini mempelajari peran Zn sebesar 1 dan 9 wt. % di dalam proses pengerasan presipitasi paduan aluminium AA319. Pengujian kekerasan dan kekuatan dilakukan untuk mengamati sifat mekanik paduan, sementara respons paduan terhadap pengerasan presipitasi diikuti melalui pengujian kekerasan. Evolusi struktur mikro diamati dengan menggunakan mikroskop optik dan SEM (scanning electron microscope) yang dilengkapi dengan EDS (energy dispersive spectroscopy). Distribusi unsur terlarut dipelajari dengan X-ray mapping pada mode back scattered electron. Hasil penelitian menunjukkan bahwa penambahan Zn sebesar 1 dan 9 wt. % pada paduan AA319 meningkatkan kekerasan dan kekuatan. Selain itu, juga terjadi transformasi morfologi fasa Al-Fe-Mn-Si dari bentuk huruf cina (chinese script) menjadi jarum (needle). Transformasi ini diperkirakan terjadi karena larutnya Zn di dalam matriks aluminium yang mengubah tegangan permukaan antara matriks dan inti fasa interdendritik. Penambahan Zn meningkatkan respons paduan terhadap penuaan alami, namun tidak menyebabkan perubahan signifikan pada penuaan buatan di temperatur 200 oC. Zn diketahui tersegregasi di sekitar fasa Al2Cu.
.....Aluminium alloys are widely used for automotive application due to its low density and high corrosion resistance. For economic reason, casting of automotive products always uses aluminium scrap as charging materials that may result in fluctuation of content of alloying element, such as Zn. This research studies the role of Zn in precipitation hardening of AA319 aluminium alloys. Hardness and tensile testing were conducted to study the mechanical properties of the alloys, while ageing response was followed by hardness measurements. Evolution of microstructures was observed by using optical microscope and SEM (scanning electron microscope) equipped with EDS (energy dispersive spectroscopy). Distribution of solute elements was detected by x-ray mapping and formation of nanoprecipitates was observed by using TEM (transmission electron microscope). Research results showed that addition of 1 and 9 wt. % Zn on AA310 alloys increases strength and hardness. Morphology transformation of Al-Fe-Mn-Si phase from chinese script into needle shape was detected, and may be due to dissolution of Zn in aluminium matrix that change the interfacial stress between the matrix and interdendritic phases. Addition of Zn also increased response of alloys to natural ageing but no significant change was detected for artificial ageing at 200 oC. Age hardening was contributed by the formation of ? (Al2Cu) nanoprecipitates. Zn was segregated on the periphery of Al2Cu phase.