Studi pengaruh penambahan cr terhadap karakteristik komposit al-11zn-7mg berpenguat sic hasil squeeze casting untuk aplikasi balistik = Effect of cr addition on the characteristics of sic strengthened al 11zn 7mg composite produced by squeeze casting for ballistic application

Helena Septian, author

Abstrak

Baja sering digunakan sebagai material penyusun pada badan pelindung kendaraan taktis karena ketahanan balistiknya yang baik. Dengan densitasnya yang tinggi, memicu pengembangan material pengganti dengan densitas yang lebih rendah namun tetap dapat menahan penetrasi peluru. Salah satunya adalah komposit aluminium dengan penguat SiC. Pada penelitian sebelumnya, pelat komposit Al-6Mg-xZn dengan variasi 6, 9 wt.% Zn berpenguat 10 dan 20 vol.% SiC telah berhasil menahan peluru tipe III, namun masih mengalami retak dibagian belakang. Oleh karena itu, perlu adanya modifikasi matriks agar menghasilkan komposit yang lebih tangguh seperti penambahan Cr.
Pada penelitian ini dipelajari komposit Al-11Zn-7Mg berpenguat 10 vol.% SiC dengan variasi kadar Cr sebesar 0, 0.043, 0.051, 0.083 wt.% yang difabrikasi melalui metode squeeze casting. Untuk meningkatkan sifat mekanis, pelat komposit kemudian diberikan laku pelarutan pada temperatur 450 oC selama 1 jam yang dilanjutkan dengan laku penuaan pada temperatur 130 oC selama 102 jam. Karakterisasi yang dilakukan pada pelat komposit yaitu pengujian komposisi kimia menggunakan Optical Emission Spectrometry (OES), analisis struktur mikro dengan mikroskop optik (OM), Scanning Electron Microscopy (SEM) dan Energy Dispersive X-Rays (EDX), perhitungan persentase porositas dan pengukuran Secondary Dendrite Arm Spacing (SDAS) menggunakan perangkat lunak Image Pro Plus, pengujian kekerasan Rockwell B, serta pengujian impak metode charpy.
.....Steel has been used as the constituent material for body of tactical vehicle due to its high ballistic resistance. But, steel has high density that triggered developments of lighter materials with high hardness and high impact energy such as SiC strengthened aluminium composites. Previous research has shown that 10 and 20 vol.% SiC strengthened Al-6Mg-xZn with variation 6 and 9 wt.% Zn could withstand type III bullets, but cracks remained at the back of the plate. Therefore, matrix modification is needed in order to produce thougher aluminium composite such as addition of Cr.
This research used Al-11Zn-7Mg as matrix and 10 vol.% SiC as reinforcement with variation of 0, 0.043, 0.051 and 0.083 wt.% Cr which are fabricated by squeeze casting method. To improve the mechanical properties, the composite plates were solution treated at 450°C for 1 hour then aged at 130 oC for 102 hours. The characterization consisted of chemical composition testing by using Optical Emission Spectrometry (OES), microstructure analysis by using Optical Microscope (OM), Scanning Electron Microscopy (SEM) and Energy Dispersive X-Rays (EDX), porosity calculation and Secondary Dendrite Arm Spacing (SDAS) measurement by using Image Pro Plus software, hardness testing by using Rockwell B and impact testing by using charpy method.
The results showed that addition of Cr from 0 to 0.083 wt.% increased the hardness of composite from 58.8 to 61.8 HRB and decreased the impact values from 11290.4 to 10131.8 J/m2. The increase in hardness was due to solid solution strengthening of Cr in Al-Zn-Mg matrix as well as reduction of SDAS from 21.6 to

17.1 m respectively from the addition 0.043 to 0.083 wt.% Cr. Ageing at 130°C significantly increased the hardness of the composites from 83.1 to 90.7 HRB, however, Cr did not give impact on the precipitation processes. Along with the increasing hardness, the impact properties decreased which indicated reduction of toughness.