Sintesis dan karakterisasi paduan logam berpori mg ca zn hasil metalurgi serbuk dengan tih2 sebagai foaming agent = Synthesis and characterization mg ca zn metal alloy foam as powder metallurgy product with tih2 as foaming agent

Franciska Pramuji Lestari, author

Abstrak

ABSTRAK
Kebutuhan biomaterial yang semakin tinggi mendorong manusia untuk menciptakan sebuah rekayasa material, sehingga dikembangkanlah material berpori Mg-Ca-Zn dengan TiH2 sebagai foaming agent. Pembuatan material berpori Mg-Ca-Zn dengan TiH2 sebagai foaming agent ini menggunakan proses metalurgi serbuk dengan TiH2 yang tanpa diberi perlakuan panas (TiH2 untreated) dan diberi perlakuan panas (TiH2 pre-treated) pada temperatur 450°C selama 2 jam. Pada penelitian ini dilakukan variasi temperatur sinter 500°C, 550°C dan 600°C serta variasi komposisi foaming agent TiH2 un-treated dan TiH2 pre-treated sebesar 0,5%; 1,5% dan 3% untuk mengetahui karakteristik material yang meliputi temperatur dekomposisi TiH2, porositas logam berpori, struktur mikro, fasa, kekuatan tekan serta laju korosi.

Hasil menunjukkan bahwa foaming agent TiH2 pre-treated berdekomposisi melepaskan hidrogen pada temperatur 520°C serta menghasilkan pori yang lebih homogen dan stabil karena adanya lapisan oksida yang terbentuk pada partikel TiH2 pre-treated. Fasa yang terbentuk pada paduan logam Mg-Ca-Zn-TiH2 un-treated yaitu Mg, Ca2Mg5Zn13, Ca2Mg6Zn3, Mg2Ca dan TiHx, sedangkan pada paduan Mg-Ca-Zn-TiH2 pre-treated yaitu Ca2Mg5Zn13, Ca2Mg6Zn3, Mg2Ca dan TiHx, Ti3O, Ti2O dan TiH2. Peningkatan temperatur sinter dan penambahan komposisi foaming agent pada logam berpori Mg-Ca-Zn dengan TiH2 un-treated dari 500 ke 550°C mengakibatkan nilai porositas dan laju korosi meningkat, namun nilai kuat tekan menurun, dan pada temperatur sinter 600°C mengakibatkan porositas dan laju korosi menurun tetapi kuat tekan meningkat.

Peningkatan temperatur sinter dan penambahan komposisi foaming agent pada logam berpori Mg-Ca-Zn dengan TiH2 pre-treated cenderung mengalami penigkatan porositas dan laju korosi, namun menurunkan nilai kuat tekan. Dalam studi ini, hasil yang paling optimal yaitu Paduan Mg-1Ca-3Zn dengan penambahan 3%berat TiH2 pada temperatur sinter 600°C, dengan porositas sebesar 19,1% serta ratarata ukuran pori 5-7μm, kuat tekan 178,85 N/mm2 dan laju korosi 2,41 mmpy.
<hr><i>ABSTRACT
The increasing demand of biomaterial has been encouraging researchers to engineer a biodegradable material, which lead to development of porous Mg-Ca-Zn with the addition of TiH2 as a foaming agent. The synthesis of porous Mg-Ca-Zn with the addition of TiH2 as a foaming agent was performed by powder metallurgy method. The addition of TiH2 was categorized by those that pre-treated with the heat treatment at 450 C for two hours and those that untreated. In this study, the sintering process was performed at different temperatures i.e. 500°C, 550°C and 600°C. The amount of TiH2 addition was varied at 0,5%; 1,5% and 3% in weight to investigate the TiH2 decomposition temperature, porosity, microstructures, phase

formation, mechanical properties and the corrosion rate.

The characterization results of samples with the addition of pre-treated TiH2 showed that foaming agent material TiH2 was decomposed at 520°C and releasing hydrogen to develop stable and homogenous-distributed pores, due to the formation of oxide layers. The X-ray diffraction (XRD) patterns revealed that the phase formation in samples with the addition of untreated TiH2 were Mg, Ca2Mg5Zn13, Ca2Mg6Zn3, Mg2Ca and TiHx, while in samples with the addition of pre-treated TiH2wereCa2Mg5Zn13, Ca2Mg6Zn3, Mg2Ca dan TiHx, Ti3O, Ti2O dan TiH2. The increasing of sintering temperatures and foaming agent material content of porous Mg-Ca-Zn alloy with addition of untreated TiH2 affected the increasing porosity and corrosion rate, despite the lower value of compressive strength.

While the sintering temperature of 600°C gave the decreasing of porosity and corrosion rate but increasing the compressive strength. The increasing of sintering temperature and foaming agent material content of porous Mg-Ca-Zn alloy with addition of pretreated TiH2 resulted to increasing of porosity and corrosion rate, but lowering the compressive strength. In this study, the optimum sample was found to be Mg-Ca-3Zn with the addition of 3% TiH2 synthesized at 600°C, owing porosity of 19,1% with the pore sizes of 5-7μm, compressive strength of 178,85 N/mm2corrosion rate of 2,41 mmpy.</i>