

# Pengaruh temperatur canai hangat dan derajat deformasi terhadap sifat mekanis dan morfologi struktur paduan Cu-Zn 70/30 = Effect of warm rolling temperature and degree of deformation on mechanical properties and structural morphology of Cu, Zn 70/30 alloy / Eka Febriyanti

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## Abstrak

[Permintaan terhadap munisi kaliber besar untuk kebutuhan bidang HanKam di dalam negeri sangat tinggi. Oleh karena itu, produsen harus mengimpor bahan baku Cu-Zn 70/30 dari luar negeri dengan harga yang tinggi. Hal ini yang menyebabkan produsen di dalam negeri berlomba untuk menguasai teknologi pembuatan selongsong peluru kaliber besar agar dapat meningkatkan kemandirian di bidang HanKam supaya biaya produksi menjadi lebih rendah. Salah satunya adalah menggunakan proses thixocasting untuk menghasilkan preform/mangkuk Cu-Zn 70/30 dari billet yang dilanjutkan dengan ironing. Keberhasilan proses ironing tergantung dari mampu bentuk dingin material Cu-Zn 70/30 yang digunakan. Oleh karena itu, pada penelitian ini dipelajari bagaimana meningkatkan mampu bentuk dingin dengan metode thermomechanical controlled processed menggunakan teknologi canai hangat. Teknologi canai hangat dilakukan dengan metode double pass reversible sebanyak 25% x 2, 30% x 2, dan 35% x 2 dengan variabel temperatur 300oC, 400oC, dan 500oC. Dengan melakukan pengamatan metalografi baik menggunakan optical microscope maupun FE-SEM, pengujian mekanik baik uji tarik maupun uji keras mikro vickers, dan pengujian mampu bentuk dengan swift test menghasilkan kesimpulan yaitu derajat deformasi aktual canai hangat yang dilakukan tidak sesuai dengan teoritis, namun dari variabel canai hangat yang dilakukan masih bisa dihasilkan sifat mampu bentuk terbaik yaitu pada benda uji yang dideformasi canai hangat di temperatur 500oC dengan derajat deformasi aktual sebesar 38.7%. Sifat mampu bentuk yang tinggi berhubungan dengan sifat mekanik dan struktur mikro yang dihasilkan yaitu ukuran butir halus mencapai 29  $\mu$ m, berbentuk equiaxed dengan nilai GAR mencapai 1.2, dan nilai kekerasan mikro yang tinggi mencapai 155 HV. Selain itu, kekuatan UTS dan YS tertinggi masing-masing sebesar 533 MPa dan 435 MPa juga didapatkan dari benda uji yang dilakukan parameter deformasi canai hangat di temperatur 500oC dengan derajat deformasi aktual 38.7%. Sedangkan apabila dilihat dari sifat mampu bentuknya maka benda uji yang dideformasi canai hangat pada kondisi parameter ini memiliki nilai koefisien pengerasan regang yang tinggi sebesar 0.00228, nilai anisotropi normal rata-rata yang tinggi sebesar 0.5452, nilai anisotropi planar ( $r$ ) yang rendah yaitu  $r < 1$  sebesar -0.42, LDR tinggi sebesar 2.625, dan tinggi mangkuk terbesar yaitu 10.31 mm.;The needs of high calibre munition for Indonesian army is very high. To

fulfill this strategic requirement, the government has to import this munition even the price is very high. This condition stimulates local industry to obtain the latest technology to produce high calibre munition, especially on casing. It is expected that the price will be lower by producing high calibre munition in Indonesia. One of the technologies which is used to produce high calibre casing munition is thixocasting to produce pre-formed cup of Cu-Zn from billet then followed by ironing process. The quality result of ironing process is mostly dependent on cold formability of Cu-Zn 70/30 material used. Therefore, this research focuses to study how to improve cold formability by implemented thermo mechanical controlled process with warm rolling. Warm rolling is conducted on double pass reversible method with deformation 25% x 2, 30% x 2, and 35% x 2 at various temperatures 300°C, 400°C, and 500°C. The specimens are then examined and tested by several methods such as metallography using optical microscopy and FE SEM, tensile test, vickers hardness test and swift test to observe cold formability. The results indicate that the actual degree of deformation of warm rolling can not be achieved as planned due to some problems with the equipment. However, the best formability can be measured, where the best formability is obtained for specimens which were warm rolled at temperature 500°C with actual deformation 38.7%. Formability is strongly related to the mechanical properties and its microstructure where the best formability obtained for the specimens which has 29  $\mu\text{m}$  grain size in equiaxed form and has GAR value of 1.2, and maximum hardness value is 155 HV. This specimen has UTS and YS maximum are 533 MPa and 435 MPa, maximum strain hardening coefficient 0.00228, average anisotropic 0.5452, anisotropic planar  $\epsilon < 1$  at -0.42, LDR maximum 2.625, and the height of cup is 10.31 mm., The needs of high calibre munition for Indonesian army is very high. To

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