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Hardness and Microstructure of Rapidly Quenched Aluminum Alloys

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Abstract : Two simple apparatus based on the hammer and anvil principle have been constructed and used to study the microstructure and micro-hardness characteristics of some AL-base alloys. Foils with thicknesses arranging from 20 μm up to 600 μm have been obtained. The cooling rate was estimated to be in the range 10^4 - 10^5 K/sec. Microstructure study of rapidly quenched Al-30% Si foils indicated that with decreasing the foil thickness the size of primary Si crystallites decreases in the whole investigated range (0.64-0.15 mm). However, the volume fraction of the primary Si crystals in the structure remained constant down to thickness the primary Si volume fraction started to decrease. Rapid quenching of Al- 14-16% Cu showed single phase cell structure. In foils up to 0.55 mm with decreasing the foil thickness the cell size decreases and micro-hardness increases particularly in foils below 0.3 mm in thickness. Isochronal annealing of theses foils show that the highly supersaturated Al-14-16% Cu solid solution decomposes readily at relatively low temperature and short time intervals. The maximum hardness is obtained after annealing at 100 °C for 30 minutes. However with decreasing the Cu content of the foils the precipitation process is largely delayed. Eight hours of annealing at 100 °C was not enough to achieve the maximum hardness in Al-4% Cu thin foils. The achieved hardness value was more than twice of the maximum hardness obtained in articles of similar composition but conventionally aged.

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