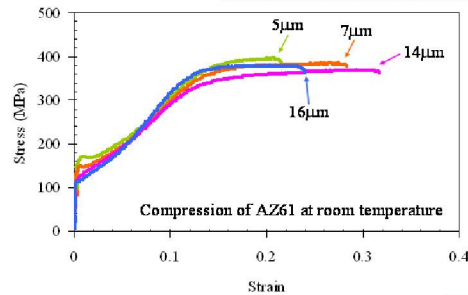


THE MICROSTRUCTURAL EVOLUTION IN HOT WORKED AND ANNEALED MAGNESIUM ALLOYS

A.G. Beer and M.R. Barnett

MOTIVATION

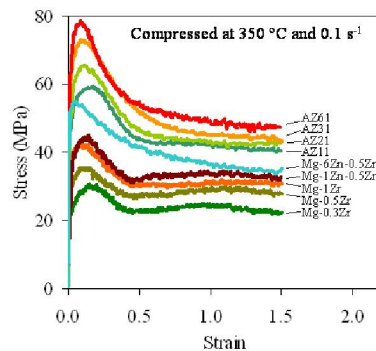
Grain refinement is a favourable technique for improving the strength of wrought magnesium alloys.



During industrial processing, the grain size increases considerably during annealing, significantly deteriorating the mechanical properties of the final product.

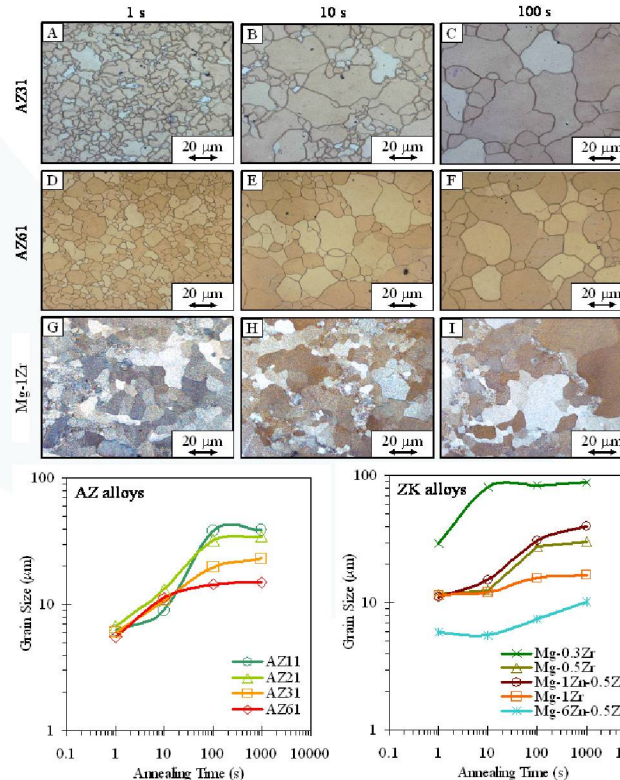
This work aims to characterize and reduce the grain coarsening of hot worked magnesium alloys.

THE HOT WORKING FLOW STRESS



An increase in the level of alloy additions resulted in an increase in the peak and steady-state flow stresses. The AZ alloys have higher flow stresses than the ZK alloys.

THE MICROSTRUCTURAL EVOLUTION



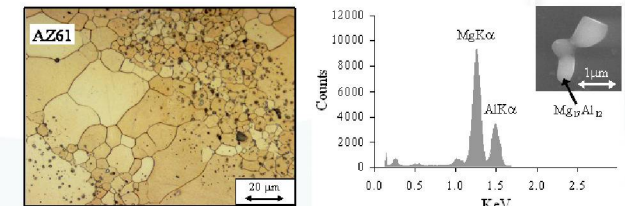
For the AZ alloys:

- the addition of aluminium did not greatly influence the grain size after annealing for 1 s.
- the stable grain size that is attained after annealing is larger with a lower Al content.
- the time at which the annealed microstructures appear stable is similar for the four alloys.

For the ZK alloys:

- the leanest alloy (Mg 0.3Zr) coarsened significantly in less than 10 s while ZK60 only exhibits a small degree of coarsening at annealing times greater than 100 s.
- small Zr additions have a strong influence on the degree of grain coarsening.
- the addition of 1.0 wt% Zn to the Mg-0.5Zr alloy made little difference to the grain size evolution.

THE ROLE OF PARTICLES



In alloys containing high levels of alloy additions, particularly AZ61 and ZK60, intermetallic particles pinned grain boundaries.

SUMMARY

Zr additions can greatly reduce the annealed grain size without greatly increasing the hot working flow stress.

Increased alloy additions reduce the stable annealed grain size.

Differences between the degrees of grain coarsening in magnesium alloys can be related to:

- differences in their stored energy (which influences recrystallization), and
- the presence of intermetallic particles.