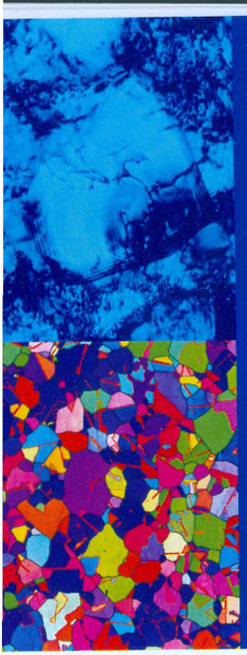

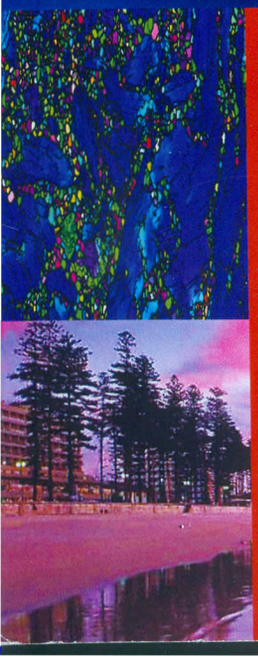

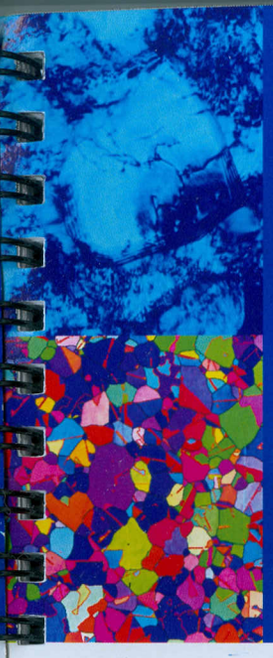

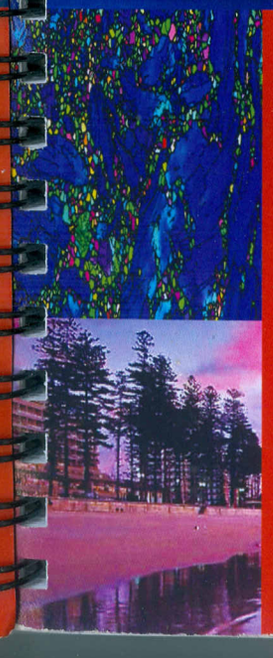

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B5: Mg Alloys

Evolution of microstructure and texture during severe plastic deformation and annealing of magnesium alloys

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The interest in deformation processing of magnesium and its alloys has spurt dueto its application potential in automobile, aerospace and electronics industries. However, these application potentials are impeded by poor formability and limited ductility at room temperature, which is a result of its hexagonal crystal structure and hence a limited operating slip system. In this regard, severe plastic deformation (SPD) is very effective in enhancing the workability and strength of Mg alloys due to grain refinement and tailoring the crystallographic texture. In this presentation, grain refinement characteristics, evolution of crystallographic texture and thermal response to the deformed microstructure and texture will be presented for pure magnesium and a few important alloys of magnesium. Two important severe plastic deformation techniques, namely equal channel angular pressing and multi-axial forging will be considered. Microstructure as well as texture evolution will be illustrated for both dynamic and static recrystallization.

1.30pm

Recrystallisation of magnesium alloys contaning rare-earth elements

Nicole Stanford[1]

[1]*Institute for Frontier Materials, Deakin University, Australia*

The static recrystallisation behaviour of two magnesium alloys after hot rolling and annealing have been examined. The alloys chosen for study were the conventional alloy AZ31, and an alloy containing the rare earth element Gadolinium. The recrystallisation kinetics were lower for the rare-earth alloyat low annealing temperatures, but at high annealing temperatures the kinetics were higher for the rare-earth alloy. It is suggested that this change in the comparative recrystallisation kinetics is a result of the improved mobility ofthe rare-earth solute at higher temperatures. This affects the recrystallisation kinetics through solute partitioning to the grain boundaries. The effect of this segregation on the recrystallisation texture is also discussed.

1.55pm

Texture evolution in dilute magnesium-rare earth alloys during hot rolling and annealing

Joseph Robson[1], **David Griffiths**[1], Bruce Davis[2]

[1]*School of Materials, University of Manchester,UK*
[2]*Magnesium Elektron North America, USA, USA*

It is well established that certain rare-earth elements in magnesium lead to a radical change in texture after hot deformation. This is of great practical importance, because formability is greatly improved if the usual strong basal texture observed in standard (non-RE containing) magnesium alloys can be suppressed. The origin of the RE effect remains uncertain and the purpose of this work was to investigate this using a series of model binary alloys containing La and Yb. These elements were chosen as they show a wide range of solubility and atomic misfit with magnesium, both factors thought to be important in producing a texture change. Additions were made at a level where the RE could be retained fully in solution to enable particle and solute effects to be differentiated. The alloys have been processed by hot rolling and annealing to study both dynamic and static recrystallization. Electron backscattered diffraction has been used to investigate the microstructure and microtexture evolution. The effect of rare earth additions on forming performance has been determined by testing under different loading conditions, elucidating qualitative relationships between formability and texture, which identify the fundamental characteristics of RE additions to magnesium.

2.15pm

Dynamic recrystallization during hot compression of WE54 magnesium alloy

Oscar Ruano[1], Manuel Carsi[1], Maria Jesús Bartolomé[1], Maria Teresa Larrea[1]

[1]*CENIM-CSIC, Spain*

The heterogeneity in the microstructure of hot compression samples during dynamic recrystallization of a WE54 alloy is studied. This magnesium alloy contains rare earth metals and have high strength at elevated temperatures. Metallographic investigation was performed in samples deformed at various temperatures and strain rates to evaluate the microstructure and its relation with the amount of deformation in the various regions of the compression samples. This is important in the production of forming parts since heterogeneous microstructures may lead to premature failure. The samples show a heterogeneous deformation pattern. During testing, the metal near the periphery of the billet can be seen as the 'easy deformed region' and material near to the geometric center can be seen as the 'difficult deformed region'. In other words, the strain is higher in the center and decreases toward its periphery. It is concluded that the heterogeneous microstructures obtained can be attributed to the heterogeneous distribution of the strain in the compression sample since the amount of deformation alters the amount of stored energy and the number of the nuclei necessary to start the dynamic recrystallization process. At 461°C the entire sample would recrystallize completely if given enough time and/or strain.

2.35pm

Multiple twinning and recrystallization of magnesium single-crystals during room-temperature compression

Konstantin Molodov[1], Talal Al-Samman[1], Dmitri Molodov[1]

[1]*Institute of Physical Metallurgy and Metal Physics, RWTH Aachen University, Germany*

Commercial purity (99.5%) magnesium single crystals were subjected to plane strain compression along the <11-20>-axis at room temperature. Extension was confined to the direction of the c-axis at a constant strain rate of 10^{-3} s^{-1}. The specimens exhibited high formability and were deformed up to a logarithmic true strain of -1. During early stages of deformation (true strain of -0.03) large-scale extension twinning was observed, gradually reorienting the entire matrix. Moreover, following the primary twinning event, secondary as well as tertiary

Tuesday 7 May 2013

	Clarendon	Norfolk	Cutler
	PLENARY SESSION Chair: Professor John Jonas, McGill University		*Sponsored by* CBMM
830	**LECTURE 3: D. Srolovitz** Towards a complete description of polycrystal topology		
915	**LECTURE 4: K. Ushioda** Heterogeneous deformation structure and evolution of recrystallization texture in steels		
1000	**Morning Tea**		
	A4: Steels - Tribute to Mike Sellars Chair: Professor Peter Hodgson, Deakin University	**B4: Recovery, Recrystallization and Grain Growth in FCC Metals** Chair: Professor Knut Marthinsen, Norwegian University of Science and Technology	**C4: Simulation and Modeling** Chair: Professor David Srolovitz, University of Pennsylvania
1030	**E. Palmiere (Inv)** Influence of strain reversal on the recrystallisation behaviour of austenite	**A. Rollett (Inv)** Impact of energy versus mobility on grain growth and recrystallization	**G. Abbruzzese (Inv)** 3-D Topological relationships and Von Neuman type equation
1055	**R. Barbosa** Grain size modelling during hot rolling of Nb microalloyed steel beams	**S. Bunkholt** Recovery kinetics in high purity and commercial purity aluminium alloys	**T-W. Na** Three-dimensional Monte Carlo simulation for the effect of precipitates and sub-boundaries on abnormal grain growth
1115	**D. Matlock** Crystallographic texture and mechanical properties of spiral welded API-X70 pipe steels	**K. Huang** Modelling the evolution in microchemistry and its effects on the softening behavior of cold rolled AlFeMnSi-alloys during annealing	**E. Galindo-Nava** Modelling dynamic recrystallization in FCC metals employing thermostatistics
1135	**A. Kostryzhev** Effect of reheating and deformation temperatures on dynamic recrystallisation of a Nb-Ti microalloyed steel	**Y. Zhang** Ex situ annealing investigations of the migration of recrystallizing boundaries in pure aluminum	**K. Phaneesh** Verification of topological grain growth rule through Monte Carlo simulation
1155	**V. Carretero Olalla** Influence of the finish rolling variables on the austenite recrystallization and grain growth	**H. Ubhi** Study of recovery and recrystallisation of a folded Al alloy	**C. Zheng** Numerical simulation of the interaction between recrystallization and phase transformation in dual phase steels
1240	**Lunch**		
	A5: Microalloyed Steels Chair: Dr Beatriz Lopez, Centro de Estudios e Investigaciones Técnicas	**B5: Mg Alloys** Chair: Professor Paulo Rios, Universidade Federal Fluminense	**C5: Nanocrystalline Materials and Grain Growth** Chair: Professor Xiaozhou Liao The University of Sydney
1330	**J.-M. Rodriguez-Ibabe (Inv)** Role of Mo on static recrystallization kinetics in coarse grained Nb microalloyed steels	**S. Suwas (Inv)** Evolution of microstructure and texture during severe plastic deformation and annealing of magnesium alloys	**C. Koch (Inv)** Thermal stability of nanocrystalline grain size in ternary Fe-base and Cu-base alloys
1355	**R. Petrov** Microstructure and properties of ultrafast annealed high strength low alloy steel	**N. Stanford** Recrystallisation of magnesium alloys contaning rare-earth elements	**D. Zöllner** Self-similarity as a feature of nanocrystalline grain growth
1415	**D. Dziedzic** Effect of austenite morphology on ferrite refinement in microalloyed steel	**D. Griffiths** Texture evolution in dilute magnesium-rare earth alloys during hot rolling and annealing	**S. Prasad** Friction-induced recrystallization and grain growth in single crystal FCC metals

	Clarendon	Norfolk	Cutler
1435	**M. Gomez** Influence of (Al, Nb, V) precipitates on the recrystallization inhibition in microalloyed steels	**O. Ruano** Dynamic recrystallization during hot compression of WE54 magnesium alloy	**D. Kaoumi** Grain-growth in nanocrystalline metals under Ion irradiation
1455	**T. Morikawa** Evolution of inhomogeneous deformation microstructures during cold-rolling of polycrystalline Ti-added ultra low carbon steel	**K. Molodov** Multiple twinning and recrystallization of magnesium single-crystals during room temperature compression	**S. Romankov** In-Situ tem observation of microstructural development in multicomponent nanolaminated structure
1515	**Afternoon Tea**		
	A6: Steels: Industrial Control of Recrystalization and Grain Growth Chair: Professor Eric Palmiere, The University of Sheffield	**B6: Experimental development and characterization** Chair: A/Professor Sandra Piazolo, Macquarie University	**C6: Abnormal Grain Growth** Chair: Dr Dorte Juul Jensen, Technical University of Denmark
1545	**J. Jonas (Inv)** Deleterious effects of austenite recrystallization on the toughness of high-strength steels	**D. Field (Inv)** Experimental development and characterization	**G. Rohrer (Inv)** Grain boundary energies, grain boundary complexion transitions, and grain growth
1610	**S. Subramanian (Inv)** Recrystallization and grain coarsening control in processing high niobium microalloyed line pipe steels	**S. Zaefferer (Inv)** Accurate and quantitative measurement of plastic strain by SEM-based diffraction techniques	**N.M. Hwang (Inv)** Abnormal grain growth of metals approached by sub-boundary enhanced solid-state wetting
1635	**C. Shang** The effect of high Nb on static recrystallization in steel	**M. Ziehmer** Examination of the Cu grain-boundary-energy phase-space by EBSD and sphere-on-a-plate method	**N. Bozzolo** Strain assisted abnormal grain growth in nickel base superalloys

1655	**F. Barbaro** Grain coarsening characteristics of modern niobium microalloyed steels	**A. Halfpenny** Crystallography of natural and experimental gold alloy microstructures	**J. Dake** Abnormal grain growth in nanocrystalline materials
1715	**A. Chastukhin** Effect of Reheating on Grain Size Evolution in High Strength Linepipe Steel	**M. Huang** Recrystallisation-assisted viscoplastic strain under low stresses after hot deformation	**H. Sandim** Abnormal grain growth in ferritic-martensitic Eurofer-97 steel
1735	**A. Gervasyev** Microstructure and texture parameters controlling the resistance to ductile fracture propagation in X80 pipeline steel	**M. Pearce** Chemically driven recrystallization and gold mineralisation	**A. Agnoli** A Zener pinning model based on a level set method