A one day technical course on all aspects of Nickel and its applications.

Course aims
The course aims to provide delegates with a full understanding of the characteristics of a wide range of nickel alloys, the fabrication of nickel components and the service conditions to which they are suited.

Who should attend
This course is aimed at those with some metallurgical background, but no in-depth knowledge of nickel. It will be of interest to recent graduates, designers, engineers, senior supervisors/technicians and sales personnel working in or supplying aerospace, defence, offshore, chemical and oil & gas industries.

“The course exceeded all of my expectations. A bonus of the day, the course was very enjoyable”
Dr Tony Hart, Hart Materials Ltd

“The course gave a good overview and provided useful reference information for discussions with customers”
David Butterworth, Project Manager, London & Scandinavian Metallurgical Co Ltd

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Nickel Metallurgy

Introduction to Nickel & Nickel Alloys

- Minerals & ores
- Nickel mining & refining
- Major suppliers of Nickel
- Applications of Nickel
- Range of Nickel alloys

Melting & Processing of Nickel

- Melting
- Casting
- Refining and re-melting
- Powder Metallurgy
- Hot working
- Cold working
- Other processes

Fabrication of Nickel Alloys

- Strain hardening
- Storage & handling of Nickel
- Heat Treatment
- Machining
- Welding

Birth of Nickel: Super Nova Explosion

- Nickel isotopes expelled from a star as it expands during a supernova event

Melting and Processing of Nickel Alloys

- 65,000 tonne Forge Press

Tube and pipe forming

- Mandrel or filler required when w/t < 7% cold
- Low mo. fillets require careful removal
- Tooling to limit galling
- Material in annealed condition for min. radius
Engineering the Next Generation

**Legislation, Health & Safety Aspects**

- EU Legislation & REACH
- Ingestion & Inhalation
- Contact – Dermatitis
- Soluble Nickel
- Oxidic Nickel
- Effects of Welding fume
- Exposure limits

**Nickel Alloys – Aqueous Corrosion resistance**

- Nickel
- Nickel-Copper
- Nickel-Iron-Chromium
- Nickel-Chromium-Iron
- Nickel-Chromium-Molybdenum
- Nickel-Molybdenum
- Acids & alkalis
- Pitting & stress corrosion

**Nickel Alloys for High Temperature Applications**

- Oxidation
- Carbursation
- Sulphidation
- Nitridation

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Nickel Metallurgy

Learning Outcomes

• Understand the sources of nickel and the formulation of a range of nickel alloys
• Discuss the fabrication processes used to manufacture products from nickel
• Comply with legislation relating to REACH, COSHH & the minor impact of nickel exposure on human health
• Appreciate the resistance of a wide range of nickel alloys to aqueous & high temperature corrosion in key applications