UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Metals Science and Sustainability

2425-1-FSM01Q009

Aims

Understanding the peculiar properties of metallic materials and the role of metallic elements in the functional applications, with a special emphasis to the relative scarcety and the recycling processes.

Contents

Material properties of metals and alloys
Metallic elements in functional applications
Sustainability, recycling and geopolitics of rare metals

Detailed program

Material properties of metals and alloys
Bonding and structure of simple metals and transition metals
Elements of mechanical and elastic properties
Alloy formation and their structural changes: Miadema and Hume-Rothery models
Microstructure: grain boundaries, extended defects, and point defects
Diffusionless (martensitic) transformations
Atomic diffusion and precipitation
Metallic elements in functional applications
Synthesis, deposition and solid-state reactions in metallization processes
Metals for ICT and energy applications
Diffusion and elettromigration in interconnects
Metallic elements in composite for functional applications

Superconductive metals
Sustainability, recycling and geopolitics in rare metals
Rare metals: sources, availability
Geopolitical issues in rare metals
The recycling processes

Prerequisites

Elements of Solid State Physics, including electronic transport phenomena, element of Thermodynamics and phase diagrams. Basic inorganic chemistry.

Teaching form

48 hours of front lessons in erogative modality. No remote lessons will be envisaged, but for extraordinary cases of syncronous erogation, in case rare external events, hindering the partecipation in presence.

Textbook and teaching resource

Pdf files of the presentations in Powerpoint at the lessons, including some suggestion for further readings provided at each lesson

Semester

second semester of the first year

Assessment method

Oral exam at the end of the course by means of three short questions. The knowledge acquired at the lessons will be evaluated, as described in the PDFs of the related presentations made available to students.

Office hours

Available to student request by means of one appointment, arranged by e-mail

Sustainable Development Goals

INDUSTRY, INNOVATION AND INFRASTRUCTURE | SUSTAINABLE CITIES AND COMMUNITIES | RESPONSIBLE CONSUMPTION AND PRODUCTION