

Tutorial on EduPack

Presented by:

Syed Haris Iftikhar

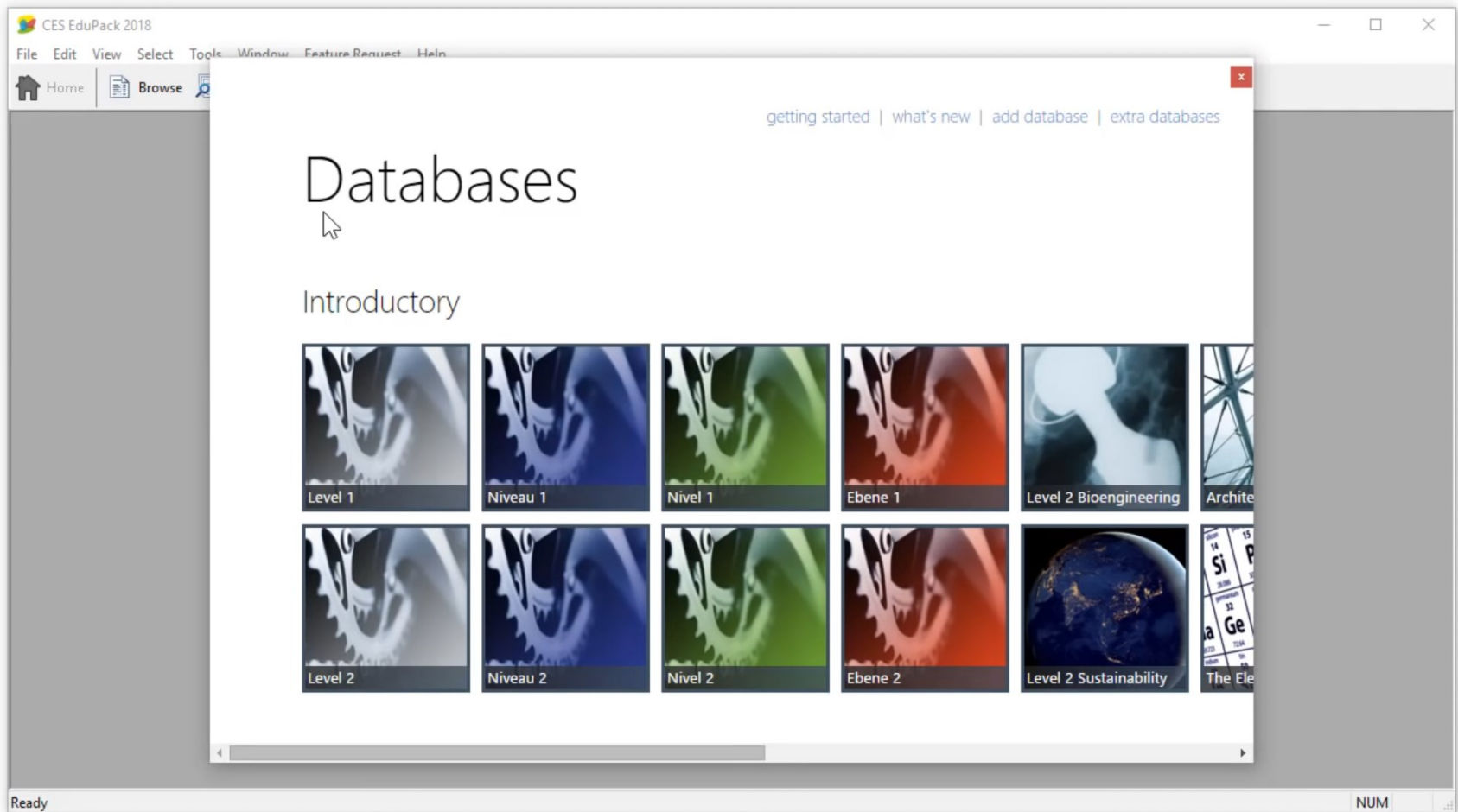
PhD Student

Department of Mechanical Engineering

UAE University, UAE

Opening a database

- On starting CES EduPack, Databases window appears, showing all installed databases



Select Level 1

Level 1

change database first steps

1. Select a table

MaterialUniverse



ProcessUniverse

2. Filter by subset



All Materials



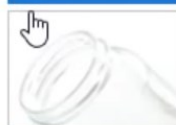
Composites



Elastomers



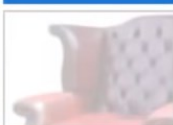
Foams



Glasses



Metals and Alloys



Natural Materials



Non-Technical
Ceramics

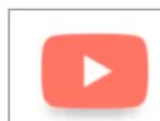


Polymers



Technical
Ceramics

More information



Video tutorials



Database
information

More resources



Extra



Education Hub

Select a subset of engineering materials

The screenshot displays the MaterialUniverse web application interface. The top navigation bar includes links for Home, Browse, Search, Chart/Select, Eco Audit, Synthesizer, Learn, Tools, Settings, and Help. The left sidebar, titled 'Browse', shows a tree view of the material hierarchy under 'MaterialUniverse'. The main content area, titled 'Level 1', features a 'change database' button and a 'first steps' link. Below these, there are two main sections: '1. Select a table' and '2. Filter by subset'. The '1. Select a table' section lists 'MaterialUniverse' (selected) and 'ProcessUniverse'. The '2. Filter by subset' section displays a grid of material categories with representative images: All Materials, Composites, Elastomers, Foams, Glasses, and Metals and Alloys. On the right side, there are two sections: 'More information' with links to 'Video tutorials' and 'Database information', and 'More resources' with links to 'Extra' and 'Education Hub'.

Home Browse Search Chart/Select Eco Audit Synthesizer Learn Tools Settings Help

Browse

Database: Level 1 Change...

Table: MaterialUniverse

Subset: All materials

MaterialUniverse

- Ceramics and glasses
 - Glasses
 - Non-technical ceramics
 - Technical ceramics
- Hybrids: composites, foams, natural materials
 - Composites
 - Foams
 - Natural materials
- Metals and alloys
 - Ferrous
 - Non-ferrous
- Polymers and elastomers
 - Elastomers
 - Polymers

Level 1

change database first steps

1. Select a table

MaterialUniverse >

ProcessUniverse

2. Filter by subset

All Materials Composites

Elastomers Foams

Glasses Metals and Alloys

More information

Video tutorials Database information

More resources

Extra Education Hub

Select metals and alloys

Untitled - CES EduPack 2018 - [MaterialUniverse:]

File Edit View Select Tools Window Feature Request Help

Home Browse Search Chart/Select Eco Audit Synthesizer Learn Tools Settings Help

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 - Elastomers
 - Polymers

Metals and alloys

Datasheet view: All properties Show/Hide

Description

Image



Caption

(1) Monkey wrench, made from low alloy steel. © Angelo_Giordano at Pixabay [Public domain] (2) Brass trumpet. © Schuetz-mediendesign at Pixabay [Public domain] (3) Stainless steel corkscrew. © Stones at Pixabay [Public domain] (4) Gold-plated pins on a CPU processor chip. © Blickpixel at Pixabay [Public domain]

Composition (summary) ⓘ

Metals are made from metallic elements, often combined (alloyed) with each other. The metallic elements cut a huge swathe across the left side of the periodic table: as around three-quarters of the 118 elements are metals, we have a huge range of ingredients for alloying. A few non-metallic elements are also important in alloys, and these are marked in grey on the periodic table below.

Which elements?

Ready

NUM

Select Nickel Alloys

Untitled - CES EduPack 2018 - [MaterialUniverse\Metals and alloys\Non-ferrous]

File Edit View Select Tools Window Feature Request Help

Home Browse Search Chart/Select Eco Audit Synthesizer Learn Tools Settings Help

Browse

Database: Level 1 Change...

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 - Ferrous
 - Non-ferrous
 - Aluminum alloys
 - Copper alloys
 - Gold
 - Lead alloys
 - Magnesium alloys
 - Nickel alloys
 - Silver
 - Tin
 - Titanium alloys
 - Tungsten alloys
 - Zinc alloys
 - Polymers and elastomers
 - Elastomers
 - Polymers

Home Metals and alloys Nickel alloys

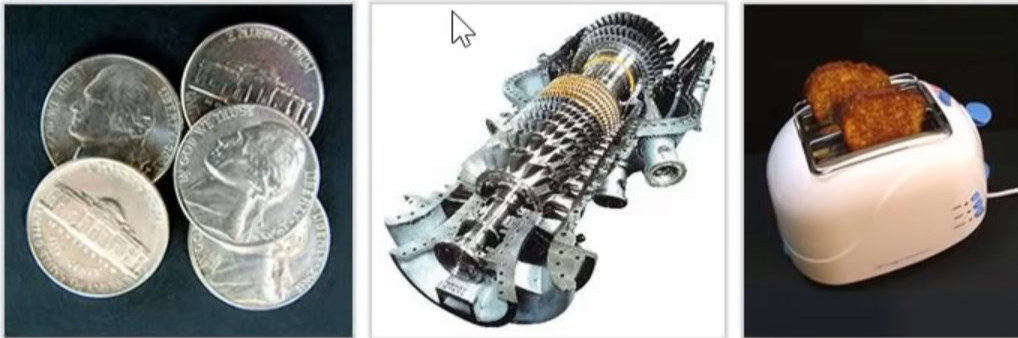
Nickel alloys

Datasheet view: All properties Show/Hide

Metals and alloys > Non-ferrous >

Description

Image



Caption

1. Nickel used in almost pure form for coinage. © Granta Design 2. Gas turbine. © Kawasaki Turbines 3. Toaster with a Nichrome heating element. an alloy of nickel and chromium. © Granta Design

The material

Nickel has a high melting point (1450 C) and is one of the few elements that are ferro-magnetic (with Fe and Co). You don't see pure nickel very often, but its alloys are everywhere. Alloyed with copper it is widely used for coinage (the Euro, the "silver" dollar, the British 50 p piece). As Nichrome, a Ni-Cr alloy, it forms the heating elements of electric fires, toasters and hair dryers. Alloyed with iron and chromium it becomes stainless steel, familiar in every kitchen. And most exotic of all are the range of nickel-based materials known as "superalloys" because of their exceptional combination of high temperature strength and corrosion resistance.

Ready NUM

Scroll down to explore properties of Ni alloys

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File Edit View Select Tools Window Feature Request Help

Home Browse Search Chart/Select Eco Audit Synthesizer Learn Tools Settings Help

Browse

Database: Level 1 Change...

Table: MaterialUniverse

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 - Polymers and elastomers

Nickel alloys

Datasheet view: All properties Show/Hide

Mechanical properties

| | | |
|--|-------------|----------------------|
| Young's modulus | 190 - 220 | GPa |
| Yield strength (elastic limit) | 70 - 1.1e3 | MPa |
| Tensile strength | 34 - 1.2e3 | MPa |
| Elongation | 2 - 60 | % strain |
| Hardness - Vickers | 80 - 300 | HV |
| Fatigue strength at 10 ⁷ cycles | * 135 - 500 | MPa |
| Fracture toughness | 80 - 110 | MPa.m ^{0.5} |

Thermal properties

| | | |
|---------------------------------|-----------------|------------|
| Melting point | 1.71e3 - 1.74e3 | K |
| Maximum service temperature | * 773 - 1.47e3 | K |
| Thermal conductor or insulator? | Good conductor | |
| Thermal conductivity | 67 - 91 | W/m.°C |
| Specific heat capacity | 452 - 460 | J/kg.°C |
| Thermal expansion coefficient | 12 - 13.5 | μstrain/°C |

Electrical properties

| | | |
|------------------------------------|----------------|--|
| Electrical conductor or insulator? | Good conductor | |
|------------------------------------|----------------|--|

Optical properties

| | | |
|--------------|--------|--|
| Transparency | Opaque | |
|--------------|--------|--|

Ready NUM

Nickel Alloys (Level 2)

Untitled - CES EduPack 2018 - [MaterialUniverse:\Metals and alloys\Non-ferrous\Nickel and alloys]

File Edit View Select Tools Window Feature Request Help

Home Browse Search Chart/Select Eco Audit Synthesizer Learn Tools Settings Help

Browse

Database: Level 2 Change...

Table: MaterialUniverse

Subset: All materials

- MaterialUniverse
 - Ceramics and glasses
 - Hybrids: composites, foams, natural materials
 - Metals and alloys
 - Ferrous
 - Non-ferrous
 - Aluminum and alloys
 - Copper and alloys
 - Gold
 - Lead and alloys
 - Magnesium and alloys
 - Nickel and alloys
 - Nickel
 - Nickel-based superalloys
 - Nickel-chromium alloys
 - Silver
 - Tin
 - Titanium and alloys
 - Tungsten alloys
 - Zinc and alloys
 - Polymers and elastomers


Nickel-based superalloys

Datasheet view: All properties Show/Hide

Metals and alloys > Non-ferrous > Nickel and alloys >

Description

Image



Caption

1. Gas turbine. © Kawasaki Turbines 2. Single superalloy blade. © Kawasaki Turbines

The material

With a name like "superalloy" there has to be something special here. There is. Superalloy is a name applied to nickel-based, iron-based and cobalt-based alloys that combine exceptional high-temperature strength with excellent corrosion and oxidation resistance. Without them, jet engines would not be practical: they can carry load continuously at temperatures up to 1200 C. The nickel-based superalloys are the ultimate metallic cocktail: nickel with a good slug of chromium and lesser shots of cobalt, aluminum, titanium, molybdenum, zirconium and iron. The data in this record span the range of high-performance nickel-based superalloys.

Ready NUM

THANK YOU!

References

<https://www.grantadesign.com/education/students/video-tutorials/>