



Modelling Materials Properties & Behaviour

- JMatPro for Al-alloys
- JMatPro for General Steels
- JMatPro for Stainless Steels
- JMatPro for Ti-alloys
- JMatPro for Co alloys

- JMatPro for Ni-alloys
- JMatPro for Cast irons
- JMatPro for Mg-alloys
- JMatPro for Zr-alloys
- JMatPro for Solder alloys

What is JMatPro?

JMatPro is a powerful software which calculates a wide range of materials properties and is particularly aimed at multicomponent alloys used in industrial practice. Standard configurations for JMatPro are based on material types, as shown above.



JMatPro has been designed so that it can be used by any engineer or scientist that requires knowledge of materials properties and behaviour as part of their daily work. We take great care in the following points:

- extensive validation of the models to ensure sound predictions of the properties.
- fast and robust calculations.
- ease of use due to an intuitive user interface (no training required).
- extensive on-line help facility.
- powerful data management interface in order to browse through calculated properties.

Uniqueness of JMatPro:

"...This software is the only reliable, commercially available software available to make calculations for stable and metastable phase equilibria; solidification behaviour and properties; thermo-physical and physical properties; phase transformations; chemical properties; and mechanical properties for number of nickel-based and iron-based superalloys ..."

- A recent client

Work on JMatPro never stops!

Please check our website for regular updates

<http://www.sentsoftware.co.uk>

What can JMatPro do?

☞ Stable and metastable phase equilibria

- ◆ Temperature stepping calculations
- ◆ Concentration stepping calculations

☞ Thermo-physical and physical properties

- ◆ specific heat
- ◆ enthalpy
- ◆ density
- ◆ thermal expansion coefficient
- ◆ linear expansion
- ◆ thermal conductivity
- ◆ electrical conductivity/resistivity
- ◆ liquid viscosity/diffusivity
- ◆ Poisson's ratio
- ◆ Young's/bulk/shear moduli
- ◆ Gamma/Gamma' mismatch

These properties are calculated for the whole temperature range including in the liquid phase. When relevant, properties are given for each phase.

☞ Solidification calculation

- ◆ Scheil-Gulliver solidification
- ◆ Modified Scheil-Gulliver solidification to include fast C and N diffusion in steels
- ◆ Thermo-physical and physical properties during solidification
- ◆ Solid state transformation in cast irons

☞ Mechanical properties

- ◆ Proof stress, tensile stress and hardness
- ◆ Inter-conversion between stress and hardness
- ◆ stress-strain curves
- ◆ creep and rupture life/strength

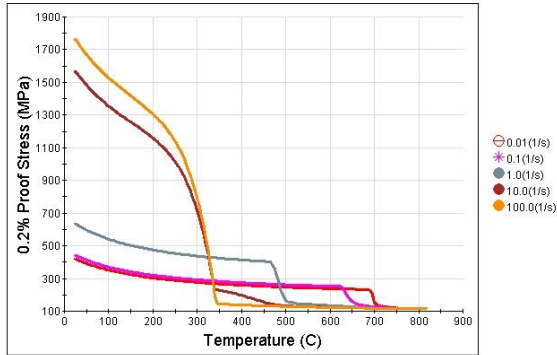
The proof stress, tensile stress and hardness are calculated at temperatures up to the melting point.

☞ Phase transformations

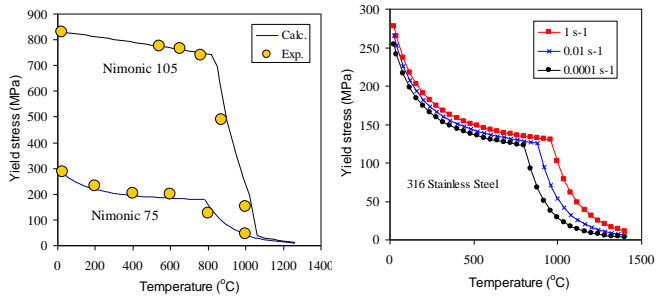
- ◆ TTT/CCT curves
- ◆ Phase transformations and properties during continuous cooling and isothermal holding
- ◆ Gamma'/Gamma" coarsening in Ni alloys

Typical calculations by JMatPro:

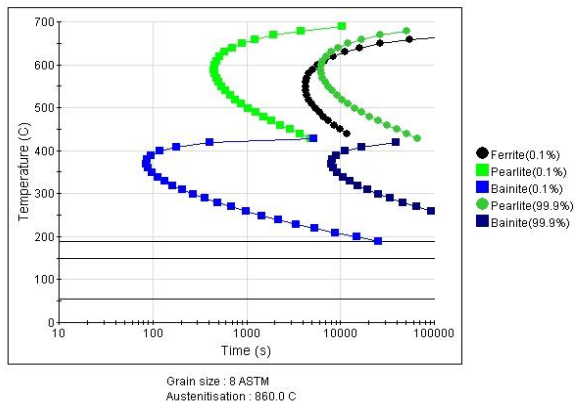
- Strength vs cooling rate and temperature - General steel 4140



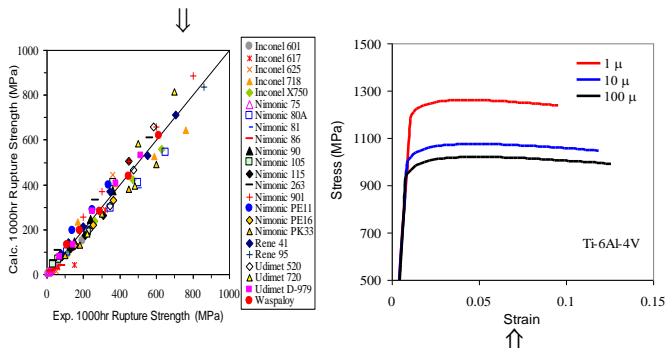
- Strength as function of temperature and strain rate



- TTT diagram - NiCr case-hardening steel



- Rupture strength - Ni-base superalloys



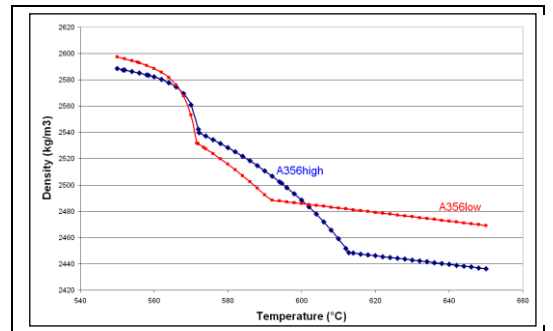
- Stress-strain curve vs grain size - Ti-6Al-4V

One frequent question:

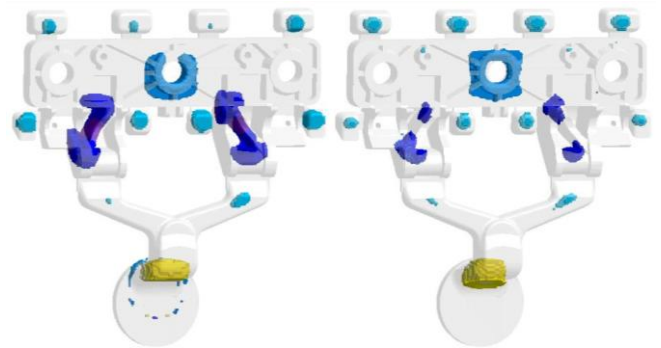
We do not develop new alloys and property data can be found in the literature or handbooks. Why should we still need JMatPro?

Looking for information in the literature or handbooks can be a painful experience, because the number of alloys for which information available is limited. You may end up with nothing after days of searching. The information may also be incomplete in that not all properties have been measured. Moreover, information from various sources may be inconsistent.

Each alloy has a specified composition range, and variations within this range may result in a big difference in the alloy's properties. As shown below the density in the mushy zone for alloy A356 is significantly different when composition changes within the specification range.



The variation of properties have significant effects on defect calculations in casting simulations. Pictures below show the difference of the calculated values for the hotspots in the casting. (Courtesy of MagmaSoft®)



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