

Development of Web-based Metal Property and Metal Information Databases

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Introduction

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Metal Property Databases

The metal property databases described here include the High Temperature Properties and General Properties of metals in the room temperature. The flow stress database, as one of the major properties of metal in hot forming, is only summarized here and will be further expanded in a separate section.

In order for user to easily access the technical data, Metal Pass provides shortcut web addresses for the major databases. Metal Pass has near 200 domain names that serve as shortcut URLs or address for satellite websites, see www.metalpass.com/services/shortcuts.aspx. A satellite website is a website focusing on a given topic but eventually links into the main site www.metalpass.com. As examples, www.metaldata.com links to the Databank, which the metal property databases belong to, and www.flowstress.com leads to the cover page of flow stress database.

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High-Temperature Properties

This database provides major metal properties at high temperature, which are critical for accurate prediction of metal hot forming parameters. All properties are provided in temperature dependence. Examples of the properties are:

- Mean Coefficients of Thermal Expansion
- Differential Coefficients of Thermal Expansion

- Modulus of Elasticity
- Mean Specific Heat
- True Specific Heat
- Electrical Resistivity
- Thermal conductivity
- Temperature conductivity
- Poisson ratio
- Etc.

The first user screen for the database is the material list screen where user can select a material. Each material has a short description on primary chemical composition. After clicking on the “Detailed Info” link, the user enters the second screen with detailed material description together with the list of available properties.

After a property (such as specific heat) is selected, the screen flushes once, and the temperature ranges for the selected properties are added into the screen inside a newly inserted table, together with the tokens needed to download the data.

When clicking on the “download this property” button, the user would be led to the third screen (**Figure 1**) if user already logged in; otherwise a login screen comes up, and after login the user is led to the third screen.

Data in **Figure 1** indicates that in certain temperature range such as 700-750°C (1290-1380°F), some carbon steel has twice as high the specific heat as in other temperatures. If a constant value of the specific heat is used, temperature prediction error is expected. In the forming process, for a given energy change Q (from heat generation or heat loss), and material mass m , there is relationship

$$Q = m \cdot C_p \cdot \Delta T$$

Where C_p is the specific heat and ΔT temperature difference. A 50% error in the specific heat C_p causes a 50% error in the temperature change ΔT . The temperature prediction error is evident. Therefore, temperature specific property data is critical for the high quality model prediction.

This database is still under intensive development. By the completion of the first stage development, there would be hundreds of steel/metal grades, with each grade having up to about ten properties available. Temperature range would be mostly up to 1000-1200°C. Further grades would be continuously added.

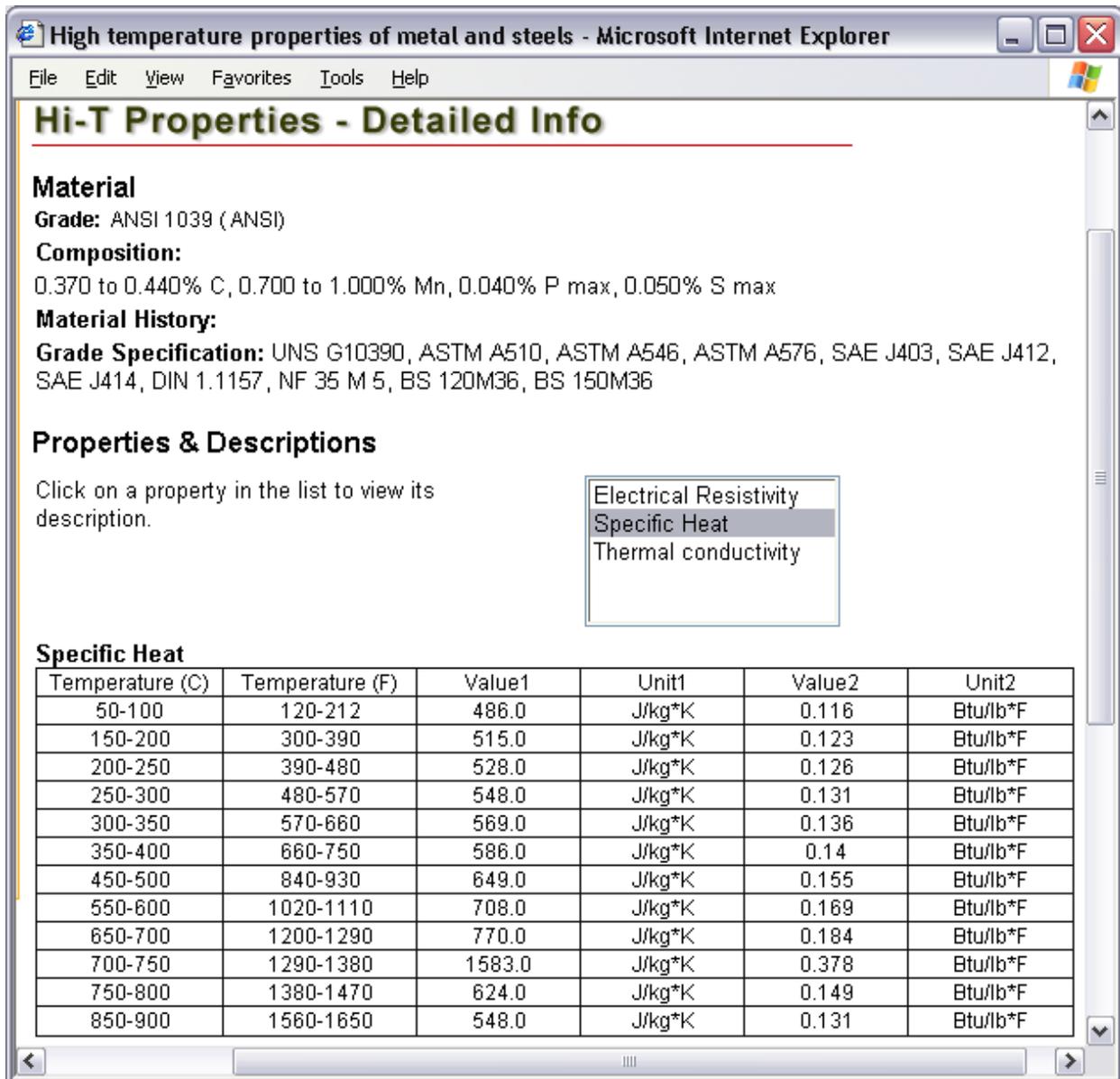


Figure 1 High-Temperature Properties data screen

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Summary

This paper introduces a list of web-based metal property and metal information databases accessible through metalpass.com. The property databases include Flow Stress, High-Temperature Property and General Property. The information databases consist of Metal

Dictionaries (both Tech Terms and Translation), Metal Software, Metal Patents, and Metal Directory, etc. Primary focus is on the metal properties such as flow stress. Data for flow stress are provided with model coefficients. Model types and user screens for the flow stress database are described. Outlines for metal information databases were provided including the extensions of the information database with short papers and model-based software suites.

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