Working with User Materials

This is a brief how-to for adding user material data files to the MPDB software (https://www.jahm.com/).

Step 1: Go to the "User Materials" tab. (Figure 1.)

a) Click the "User Materials->Add new material…" menu item. (Figure 2)
b) The add/edit material window pops up. (Figure 3)

Step 2: In the new window (Figure 3)

a) Enter a "Material name". This is required.
b) Enter a "Reference" and "Note". These are both optional.
c) You must first select the property you are entering data for.
d) Then select the "Equation Definition".
e) The select a "Phase/Condition" and an optional "Orientation/Condition".
f) You can change the name of the phase/orientation from "undefined" to a more meaningful name by right-clicking on the "undefined" you want to change. (Figure 4)
g) If you selected "x-y pairs" you enter your data points into a table (Figure 5). The program will fit straight lines between each set of data points.
h) If you select another equation type other than "x-y pairs" (Figure 6), you must select the number of equations you have fitted the data to.
i) You then enter the limits of each equation and enter their coefficients. The form and units of the equation are displayed in the "Equation Definition" section. Some properties require a "Reference temperature", this is always in Kelvin.
j) If you fit your data to an equation using Excel, you can use the "Parse Equation" button as an easy way to input your coefficients. Click the "Parse Equation" button and copy your polynomial equation from Excel and paste it into the window, then click the "OK" button. (Figures 7 & 8)
k) After you have entered your data you can plot it to make sure everything looks right. (Figure 9)
l) Click the "Save Dataset" button or the data will be lost.
m) Enter any other data for this material you like then click the "OK" button to save it as a user material.
n) The "Save Dataset" button does not save the data to your "user_mats.txt" file, it only saves it in memory. Once all changes are complete clicking the "OK" button will save it to your actual "user_mats.txt" file.
o) "User Fields" will be explained in a following section.
p) Your user materials are saved to a plain text file call "user_mats.txt". This is saved to the directory where the MPDB.exe is.

Editing a user material.

a) Go to the "User Materials" tab. (Figure 1)
b) You can edit or add data to an existing user material by either clicking on the "User Materials->Edit material…" menu item or right-clicking in the "User Materials" window to pop-up a short-cut menu. (Figure 10)
c) Any properties/phases/orientations with existing data will be highlighted in green. (Figure 11)
d) You proceed the same way as described in Step 2 to add or edit any data.

User Fields

a) The main purpose of the user fields is to allow single point non-supported data to be entered and searched. Some examples of non-supported data include: bearing strength, peel strength, hardness, fracture toughness, etc. (Figure 12)
b) You can also enter any text you like in a user field and it will function similar to the "Note".
c) The user fields are displayed along with the reference and note in the materials window. (Figure 13)
d) If you want a user field to hold data, the following conventions must be followed:
    I. Each must have an identifier, a numeric value and an optional units string, in this order. These must be followed by the ":" character (no quotes). Anything, or nothing, can follow the ":" and will simply be treated as a note. Figure 12 shows an example.
    II. The first set of characters represent the name of the property (no spaces allowed). For example, for hardness you may want to use "H" of "HB" (without the quotes). You are in control of the units. Figure 12 shows an example.
e) When you use the "Search/Report" feature from the main window any user fields will be displayed and can be searched/reported as with standard properties. (Figure 14)
f) You should have only one user field for a given property for a given user material. For example, in Figure 12, if you had another field with "HB 95:" (without the quotes) this would be two fields with the same property. If you have more than one user field with the same property only the last one will be found in the "Search/Report" routine. In this example only "95" would be displayed in the "Search/Report" routine. If you do not plan on using the "Search/Report" function for the user fields, this will not affect you and you can have as many entries for the same property as you like.

Other features

a) You can delete, reorder, or inset breaks into your user materials using the menu or pop-up short-cut commands.
b) You can have the program make automatic back-ups of your user materials. This is highly recommended. If you check the "User Materials->Back-up local user_mats.txt file" menu item a

time stamped copy will be made. This only occurs the first time you edit/add a user material in each session. If you check “User Materials->Paranoid mode” a time stamped copy will be made every time you edit/add a user material. This may happen many times a session if you are editing/adding many user materials. You may want to periodically clear out your old back-ups.

c) You can share user materials in the following way. One person is designated as the person in charge of the common database. They create the user materials in the ways mentioned above. This user_mats.txt file is then shared on a common network drive. Other users can then access this public file but cannot edit it (Figure 15). They can also keep a local copy of their own user materials and access that. You can only edit a local copy of the user_mats.txt file.

d) You can copy a standard material to a user material if you need to add some of your own data sets. Just click the “User Materials->Copy material to User Materials” menu item. You will be prompted to click a material to copy. Single-click an element or double-click a non-element to copy it to a user material.

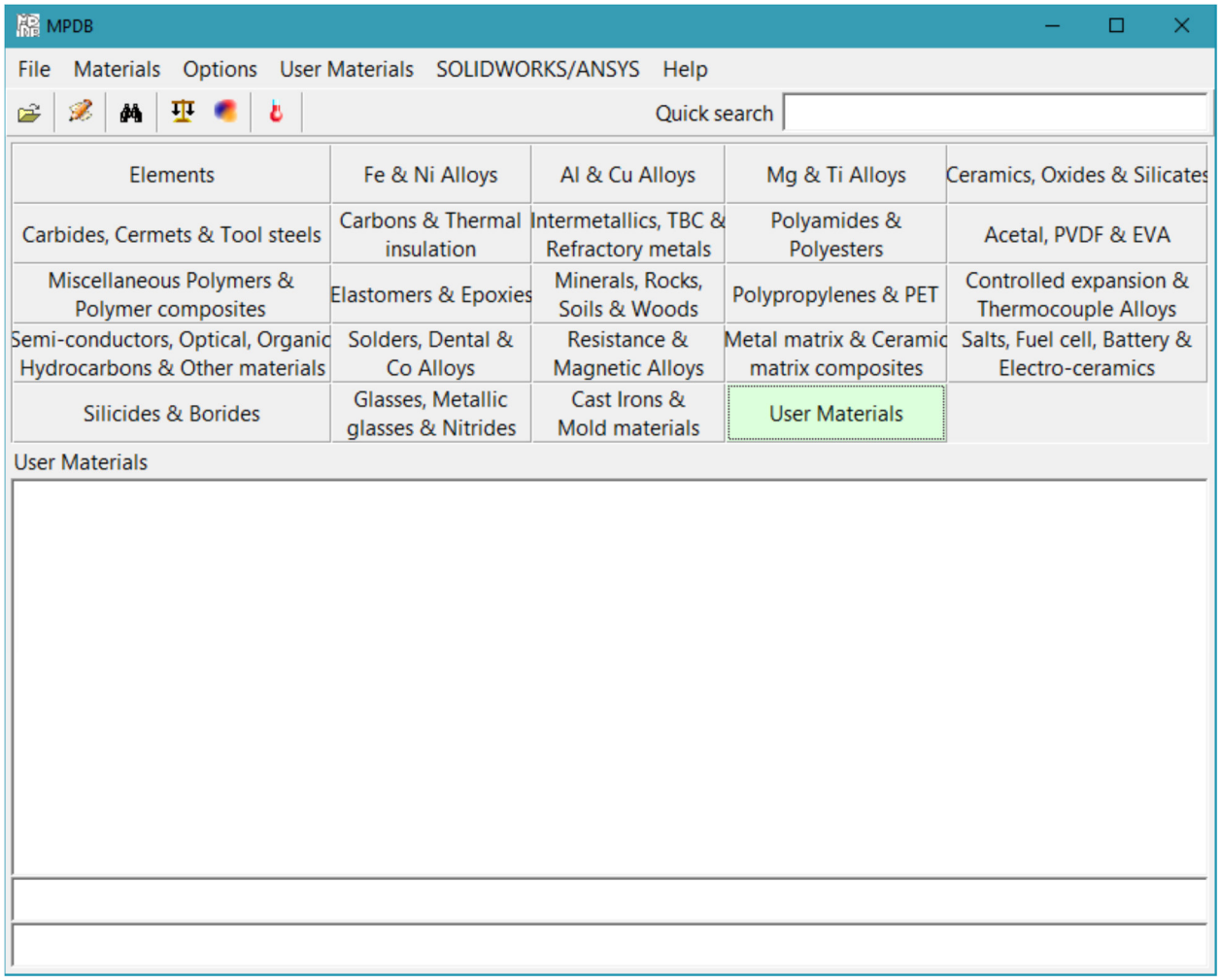
MPDB
File
Materials
Options
User Materials
SOLIDWORKS/ANSYS
Help
Quick search
Elements
Fe & Ni Alloys
Al & Cu Alloys
Mg & Ti Alloys
Ceramics, Oxides & Silicates
Carbides, Cermets & Tool steels
Carbons & Thermal insulation
Intermetallics, TBC & Refractory metals
Polyamides & Polyesters
Acetal, PVDF & EVA
Miscellaneous Polymers & Polymer composites
Elastomers & Epoxies
Minerals, Rocks, Soils & Woods
Polypropylenes & PET
Controlled expansion & Thermocouple Alloys
Semi-conductors, Optical, Organic Hydrocarbons & Other materials
Solders, Dental & Co Alloys
Resistance & Magnetic Alloys
Metal matrix & Ceramic matrix composites
Salts, Fuel cell, Battery & Electro-ceramics
Silicides & Borides
Glasses, Metallic glasses & Nitrides
Cast Irons & Mold materials
User Materials
User Materials

Figure 1.

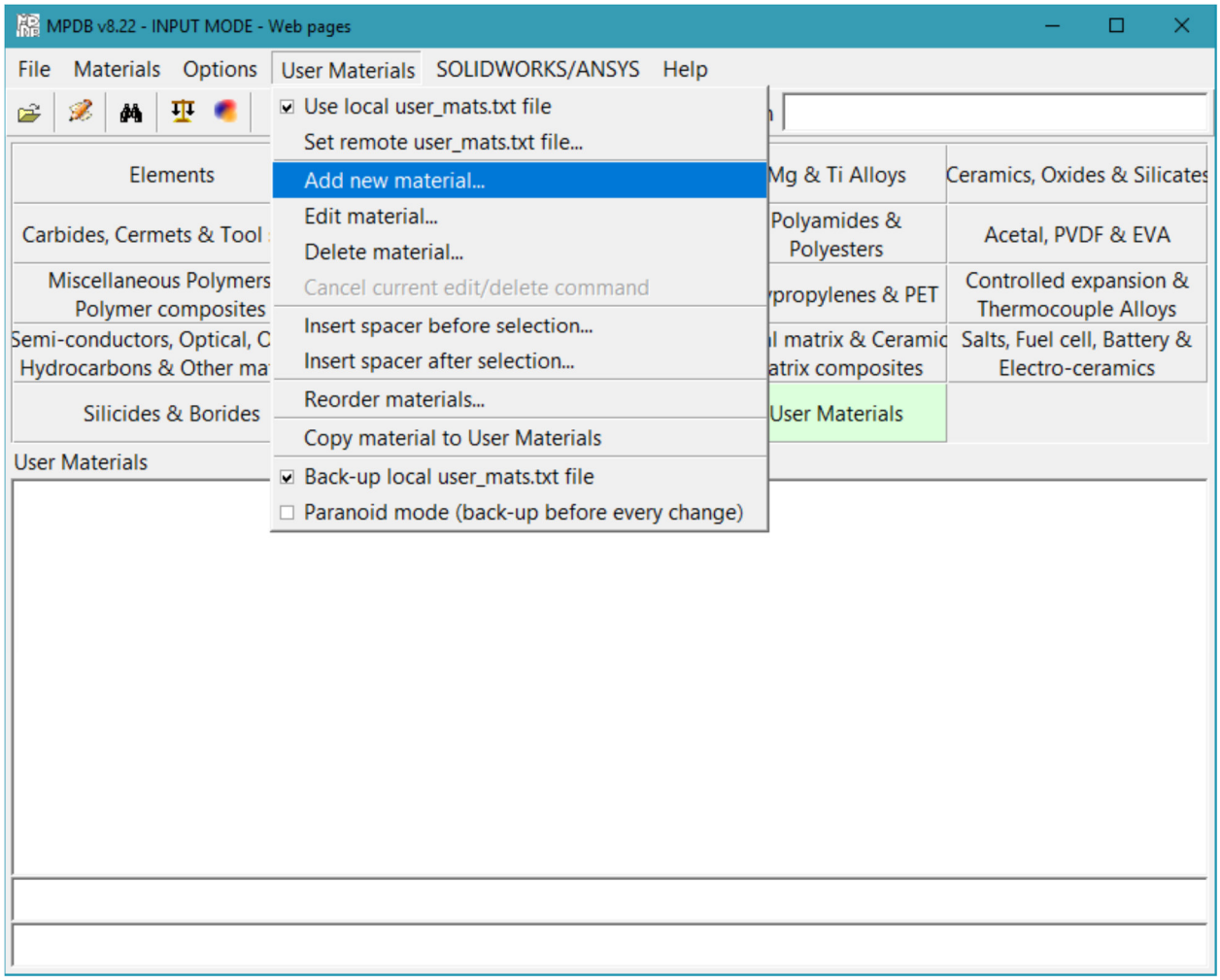
MPDB v8.22 - INPUT MODE - Web pages
File
Materials
Options
User Materials
SOLIDWORKS/ANSYS
Help
Use local user_mats.txt file
Set remote user_mats.txt file...
Add new material...
Edit material...
Delete material...
Cancel current edit/delete command
Insert spacer before selection...
Insert spacer after selection...
Reorder materials...
Copy material to User Materials
Back-up local user_mats.txt file
Paranoid mode (back-up before every change)
Elements
Carbides, Cermets & Tool
Miscellaneous Polymers
Polymer composites
Hydrocarbons & Other ma
Silicides & Borides
Mg & Ti Alloys
Polyamides & Polyesters
Ceramics, Oxides & Silicates
Acetal, PVDF & EVA
Controlled expansion & Thermocouple Alloys
Salts, Fuel cell, Battery & Electro-ceramics
User Materials
User Materials

Figure 2.

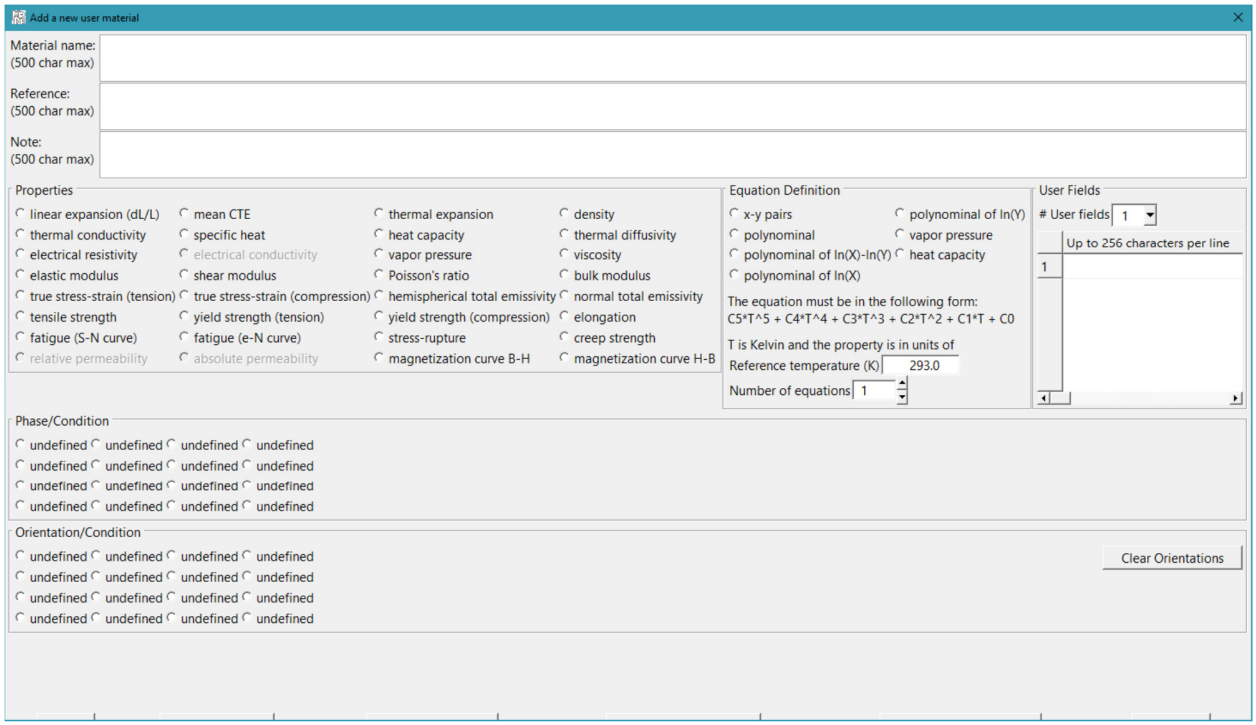

Figure 3.

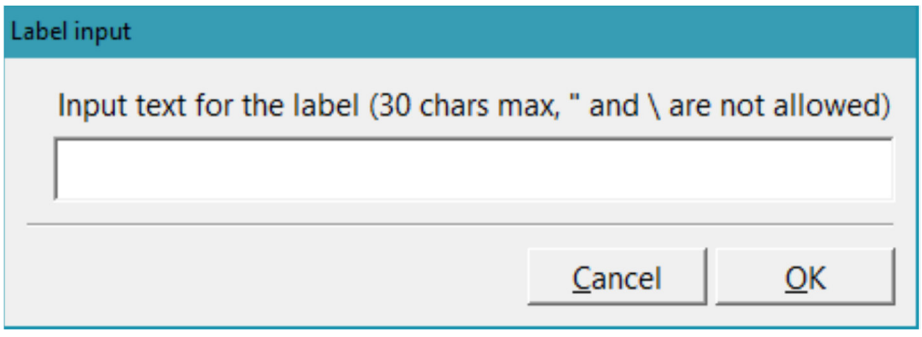

Figure 4.

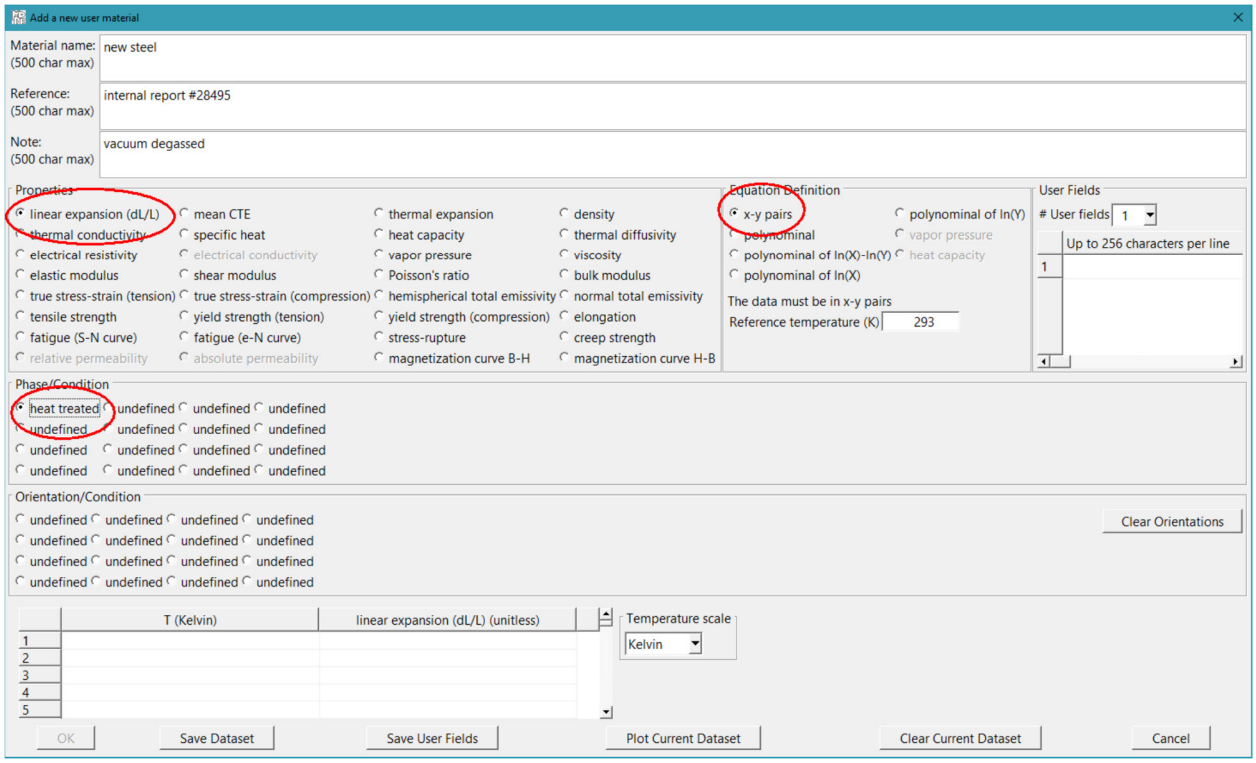
Add a new user material
Material name: (500 char max)
new steel
Reference: (500 char max)
internal report #28495
Note: (500 char max)
vacuum degassed
Properties
linear expansion (dL/L)
mean CTE
thermal expansion
density
thermal conductivity
specific heat
heat capacity
thermal diffusivity
electrical resistivity
electrical conductivity
vapor pressure
viscosity
elastic modulus
shear modulus
Poisson's ratio
bulk modulus
true stress-strain (tension)
true stress-strain (compression)
hemispherical total emissivity
normal total emissivity
tensile strength
yield strength (tension)
yield strength (compression)
elongation
fatigue (S-N curve)
fatigue (e-N curve)
stress-rupture
creep strength
relative permeability
absolute permeability
magnetization curve B-H
magnetization curve H-B
Equation Definition
x-y pairs
polynominal of ln(Y)
polynominal
vapor pressure
polynominal of ln(X)-ln(Y)
heat capacity
polynominal of ln(X)
The data must be in x-y pairs
Reference temperature (K)
293
User Fields
User fields
1
Up to 256 characters per line
Phase/Condition
heat treated
undefined
Orientation/Condition
Clear Orientations
T (Kelvin)
linear expansion (dL/L) (unitless)
Temperature scale
Kelvin
OK
Save Dataset
Save User Fields
Plot Current Dataset
Clear Current Dataset
Cancel

Figure 5.

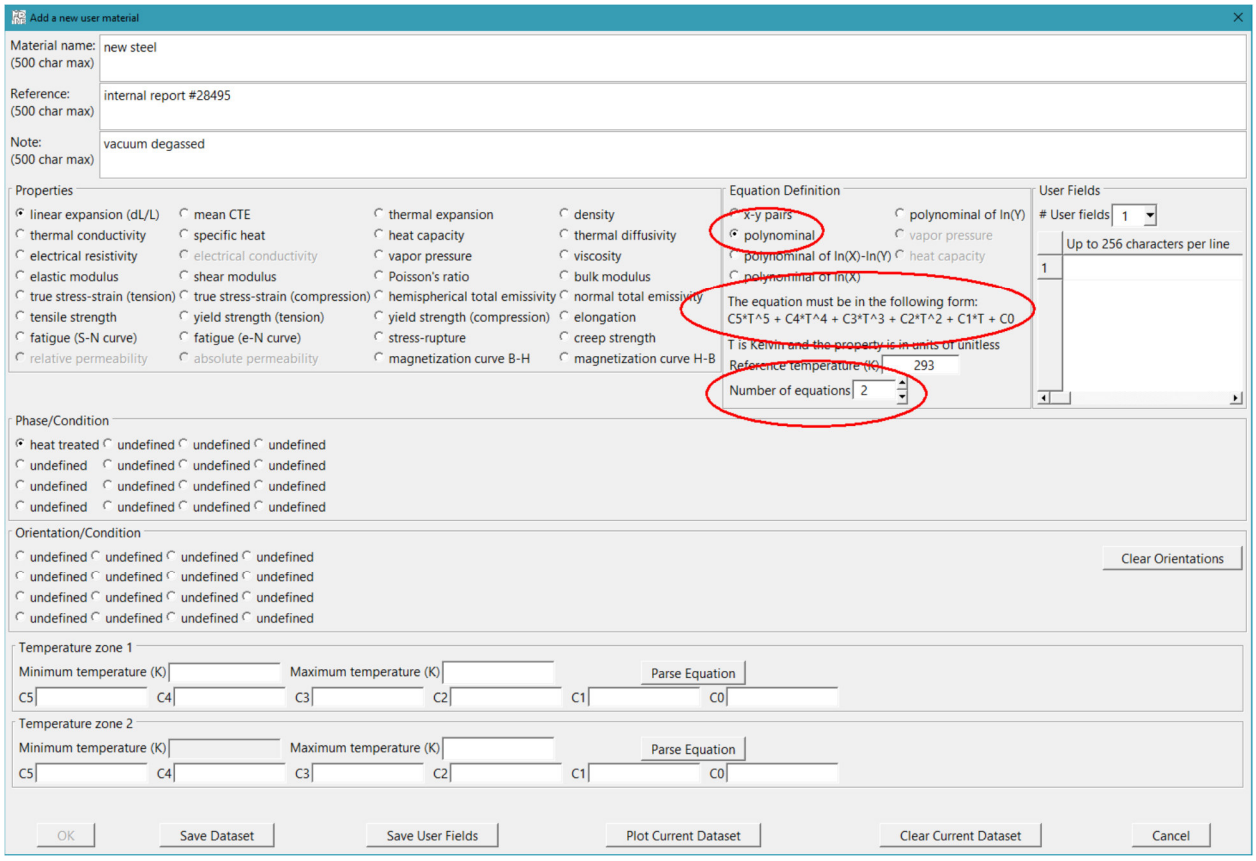

Figure 6.

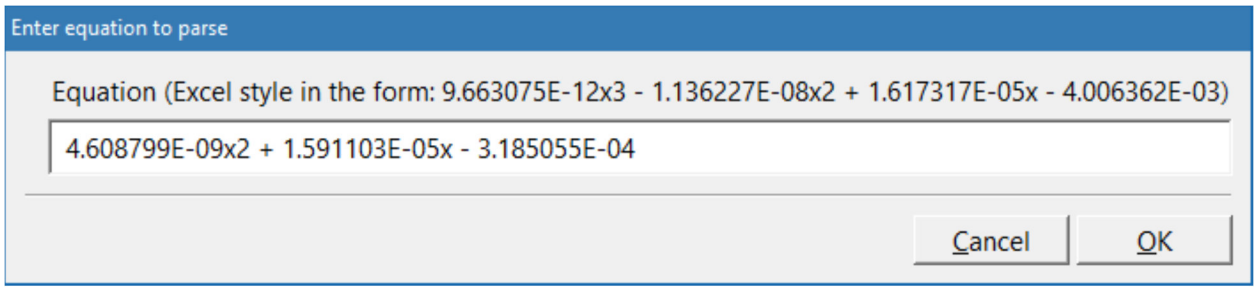

Figure 7.

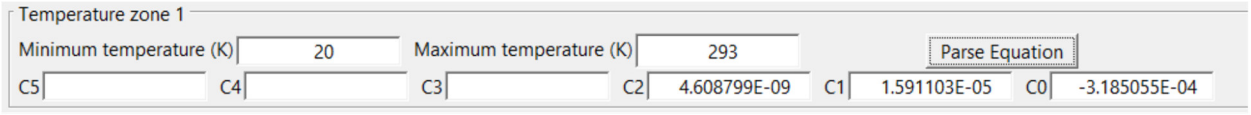

Figure 8.

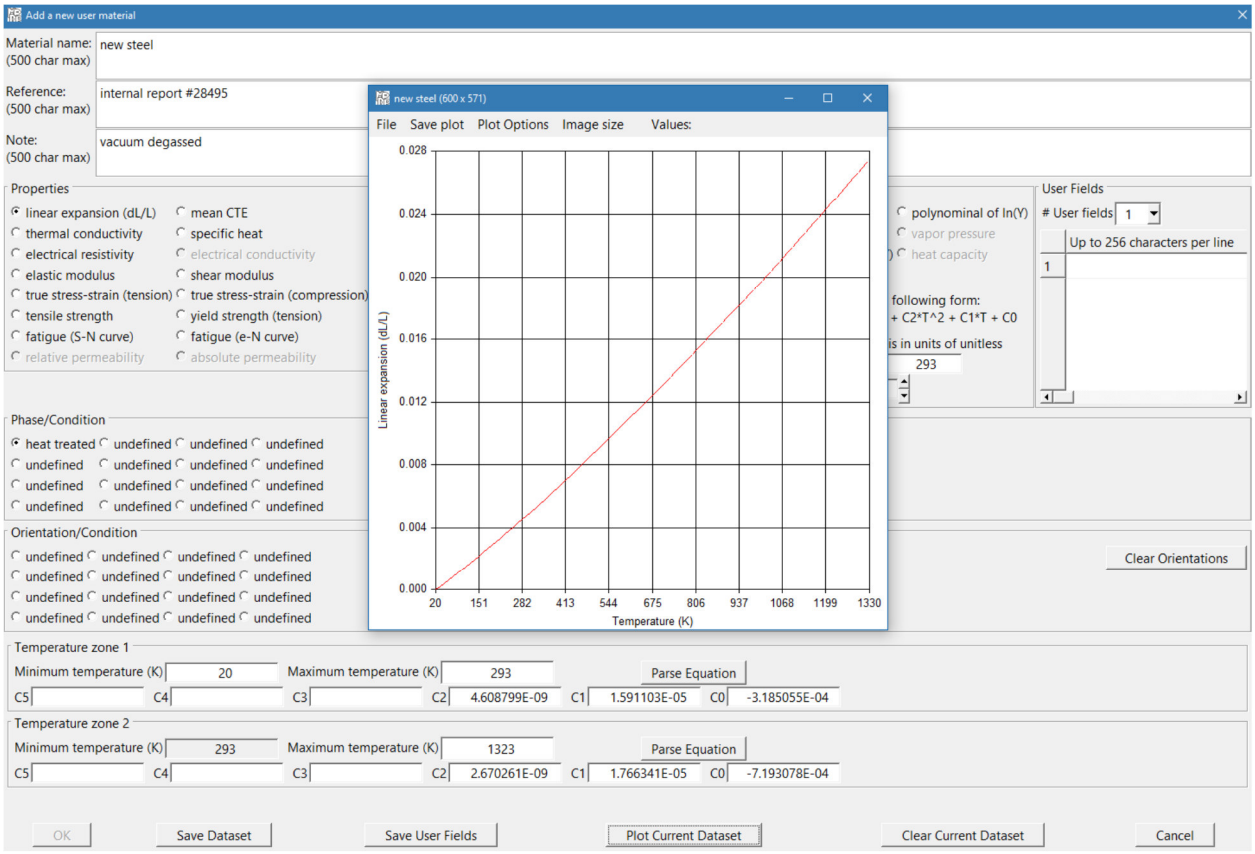
Add a new user material
Material name: (500 char max)
new steel
Reference: (500 char max)
internal report #28495
Note: (500 char max)
vacuum degassed
new steel (600 x 571)
File
Save plot
Plot Options
Image size
Values:
Linear expansion (dL/L)
Temperature (K)
0.028
0.024
0.020
0.016
0.012
0.008
0.004
0.000
20
151
282
413
544
675
806
937
1068
1199
1330
Properties
linear expansion (dL/L)
mean CTE
thermal conductivity
specific heat
electrical resistivity
electrical conductivity
elastic modulus
shear modulus
true stress-strain (tension)
true stress-strain (compression)
tensile strength
yield strength (tension)
fatigue (S-N curve)
fatigue (e-N curve)
relative permeability
absolute permeability
polynominal of ln(Y)
vapor pressure
heat capacity
following form:
+ C2*T^2 + C1*T + C0
is in units of unitless
293
User Fields
User fields 1
Up to 256 characters per line
Phase/Condition
heat treated
undefined
Orientation/Condition
Clear Orientations
Temperature zone 1
Minimum temperature (K) 20
Maximum temperature (K) 293
Parse Equation
C5
C4
C3
C2 4.608799E-09
C1 1.591103E-05
C0 -3.185055E-04
Temperature zone 2
Minimum temperature (K) 293
Maximum temperature (K) 1323
Parse Equation
C5
C4
C3
C2 2.670261E-09
C1 1.766341E-05
C0 -7.193078E-04
OK
Save Dataset
Save User Fields
Plot Current Dataset
Clear Current Dataset
Cancel

Figure 9.

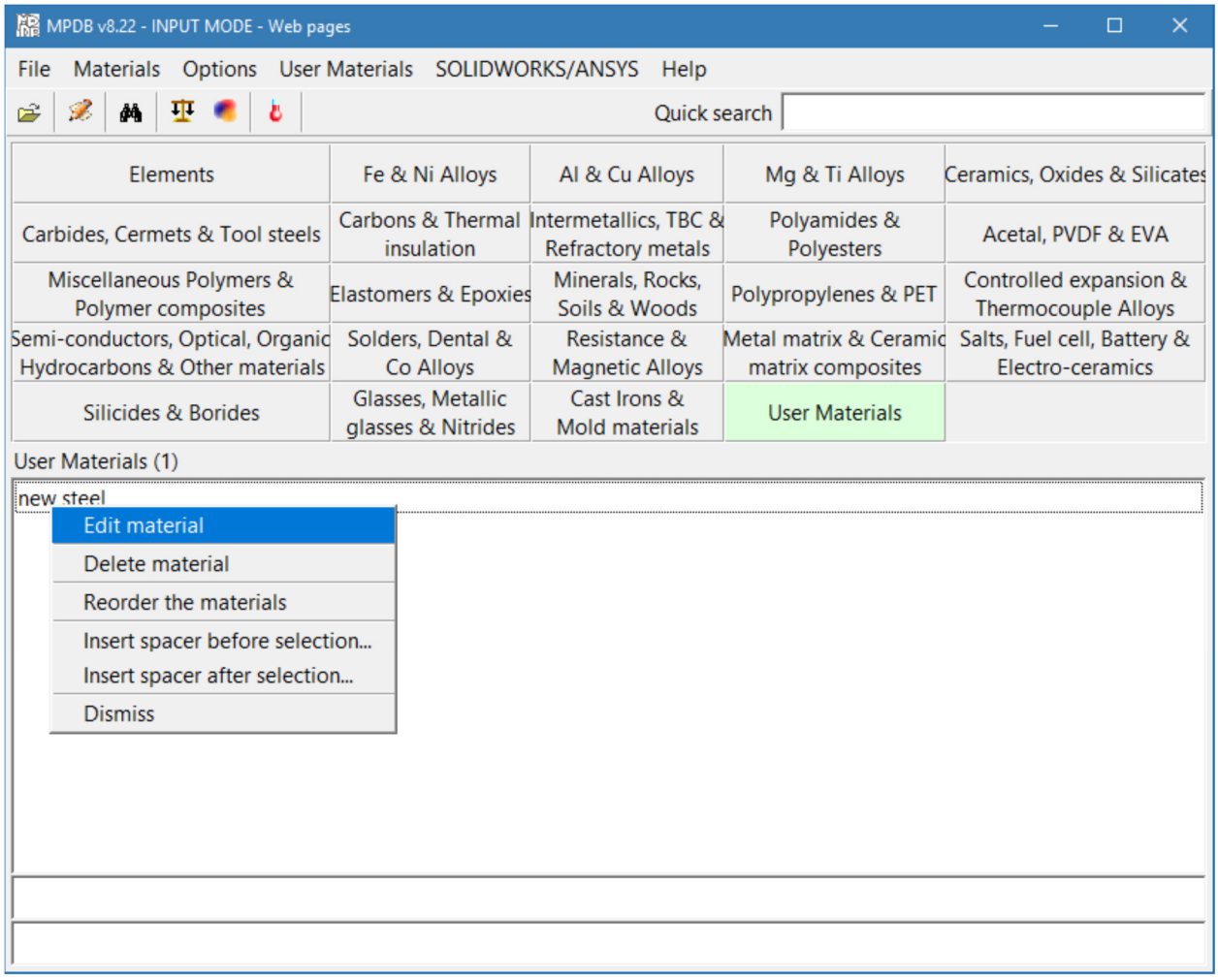
MPDB v8.22 - INPUT MODE - Web pages
File
Materials
Options
User Materials
SOLIDWORKS/ANSYS
Help
Quick search
Elements
Fe & Ni Alloys
Al & Cu Alloys
Mg & Ti Alloys
Ceramics, Oxides & Silicates
Carbides, Cermets & Tool steels
Carbons & Thermal insulation
Intermetallics, TBC & Refractory metals
Polyamides & Polyesters
Acetal, PVDF & EVA
Miscellaneous Polymers & Polymer composites
Elastomers & Epoxies
Minerals, Rocks, Soils & Woods
Polypropylenes & PET
Controlled expansion & Thermocouple Alloys
Semi-conductors, Optical, Organic Hydrocarbons & Other materials
Solders, Dental & Co Alloys
Resistance & Magnetic Alloys
Metal matrix & Ceramic matrix composites
Salts, Fuel cell, Battery & Electro-ceramics
Silicides & Borides
Glasses, Metallic glasses & Nitrides
Cast Irons & Mold materials
User Materials
User Materials (1)
new steel
Edit material
Delete material
Reorder the materials
Insert spacer before selection...
Insert spacer after selection...
Dismiss

Figure 10.

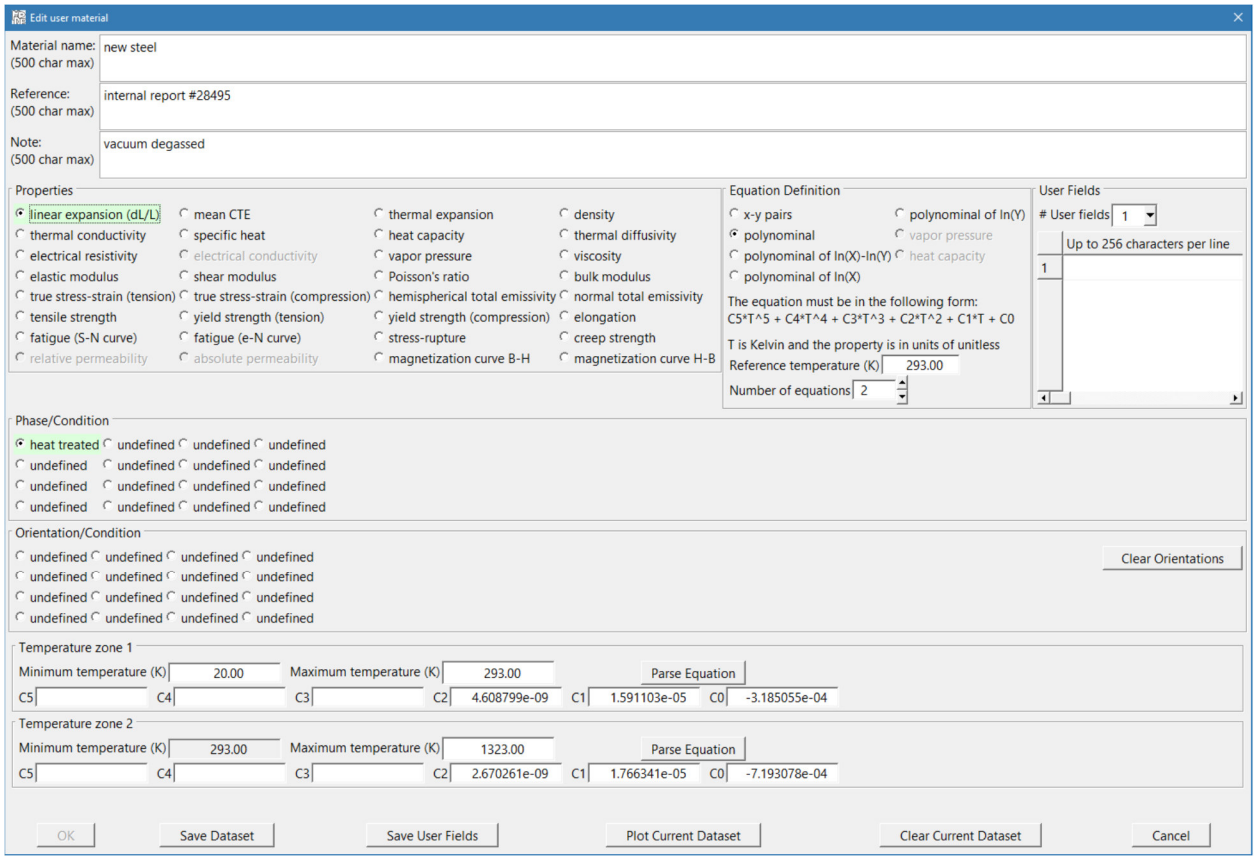

Figure 11.

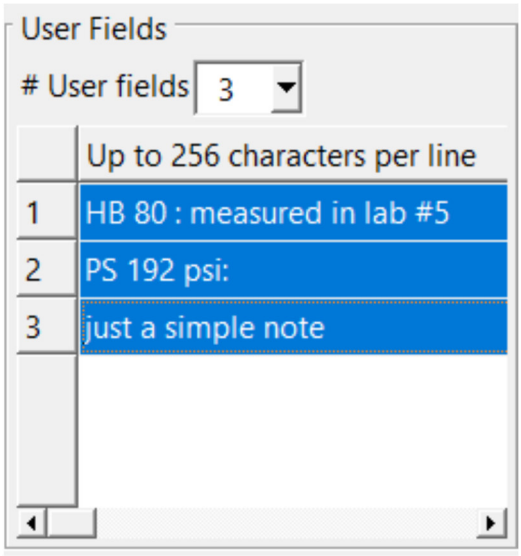

Figure 12.

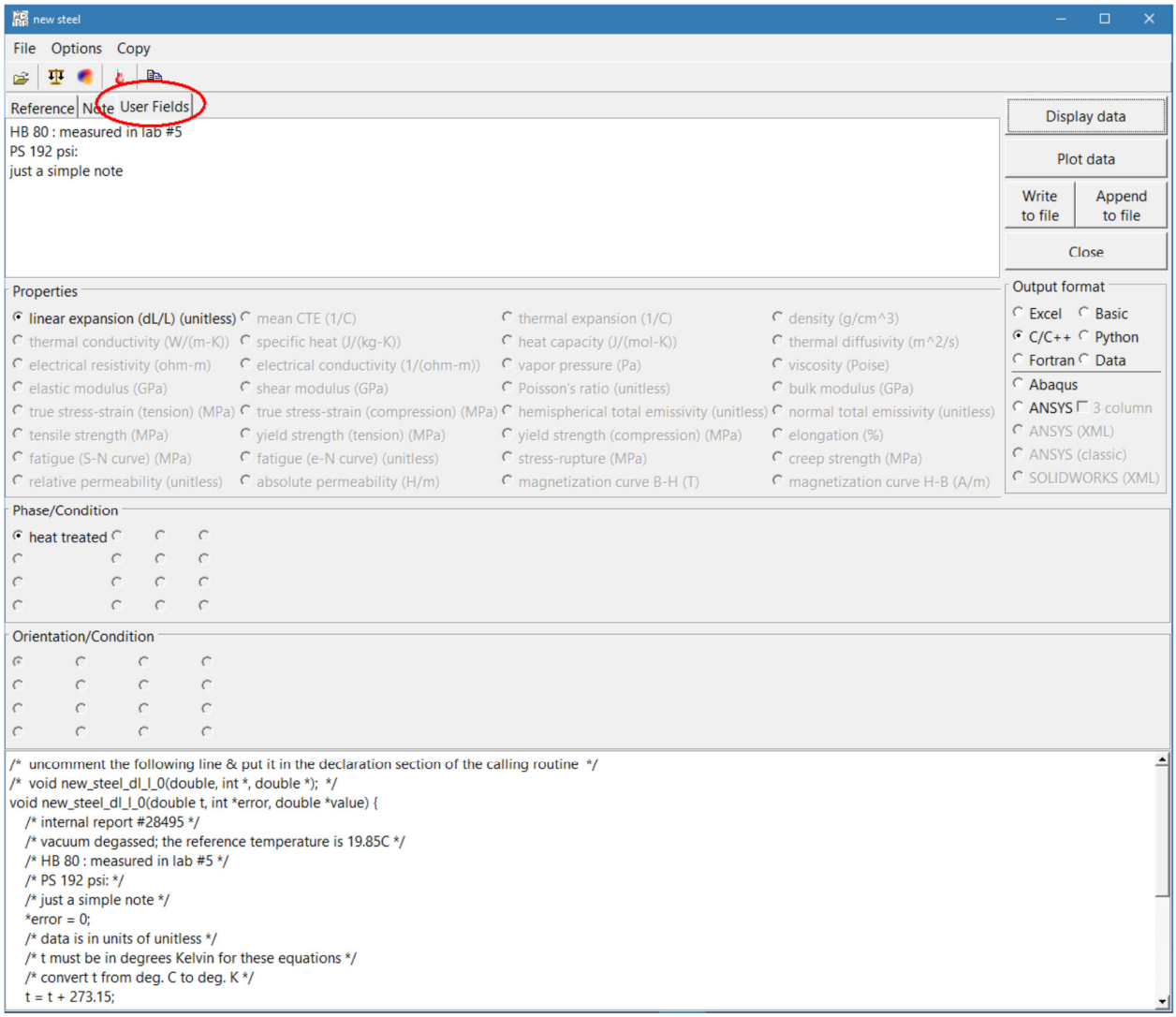
new steel
File Options Copy
Reference Note User Fields
HB 80 : measured in lab #5
PS 192 psi:
just a simple note
Display data
Plot data
Write to file
Append to file
Close
Properties
linear expansion (dL/L) (unitless)
mean CTE (1/C)
thermal expansion (1/C)
density (g/cm^3)
thermal conductivity (W/(m-K))
specific heat (J/(kg-K))
heat capacity (J/(mol-K))
thermal diffusivity (m^2/s)
electrical resistivity (ohm-m)
electrical conductivity (1/(ohm-m))
vapor pressure (Pa)
viscosity (Poise)
elastic modulus (GPa)
shear modulus (GPa)
Poisson's ratio (unitless)
bulk modulus (GPa)
true stress-strain (tension) (MPa)
true stress-strain (compression) (MPa)
hemispherical total emissivity (unitless)
normal total emissivity (unitless)
tensile strength (MPa)
yield strength (tension) (MPa)
yield strength (compression) (MPa)
elongation (%)
fatigue (S-N curve) (MPa)
fatigue (e-N curve) (unitless)
stress-rupture (MPa)
creep strength (MPa)
relative permeability (unitless)
absolute permeability (H/m)
magnetization curve B-H (T)
magnetization curve H-B (A/m)
Output format
Excel Basic
C/C++ Python
Fortran Data
Abaqus
ANSYS 3 column
ANSYS (XML)
ANSYS (classic)
SOLIDWORKS (XML)
Phase/Condition
heat treated
Orientation/Condition
/* uncomment the following line & put it in the declaration section of the calling routine */
/* void new_steel_dl_l_0(double, int *, double *); */
void new_steel_dl_l_0(double t, int *error, double *value) {
/* internal report #28495 */
/* vacuum degassed; the reference temperature is 19.85C */
/* HB 80 : measured in lab #5 */
/* PS 192 psi: */
/* just a simple note */
*error = 0;
/* data is in units of unitless */
/* t must be in degrees Kelvin for these equations */
/* convert t from deg. C to deg. K */
t = t + 273.15;

Figure 13.

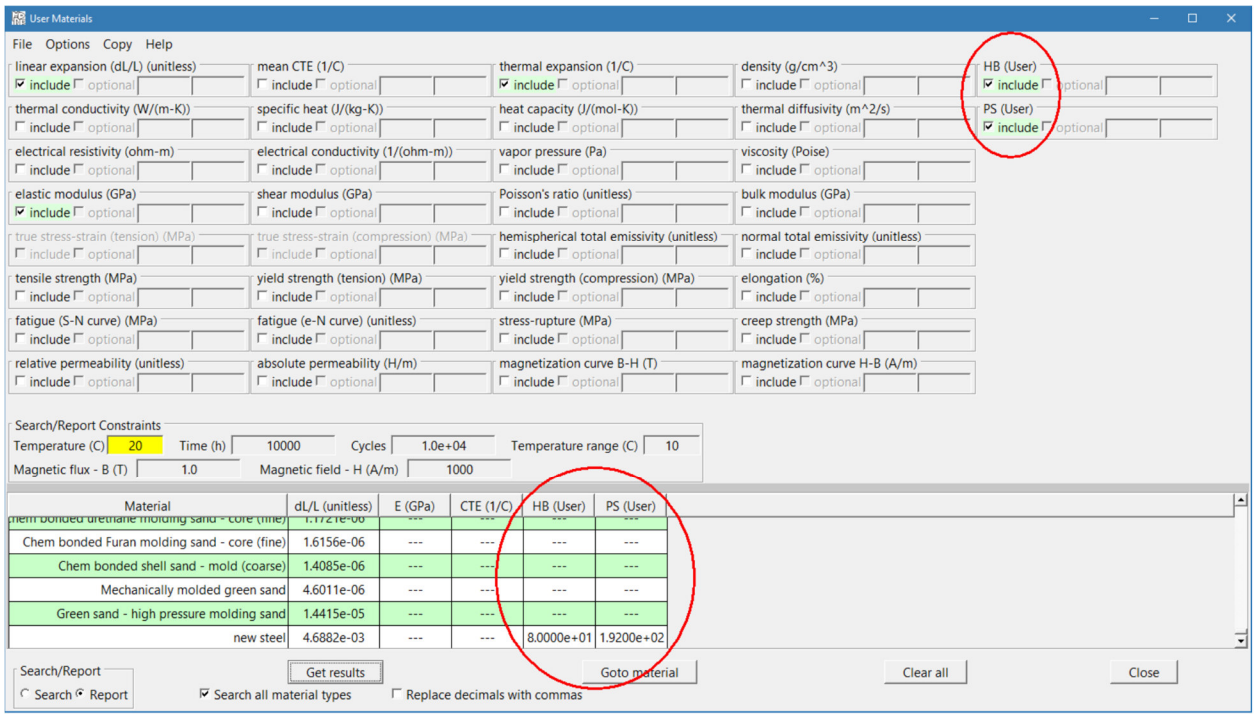
User Materials
File Options Copy Help
linear expansion (dL/L) (unitless)
mean CTE (1/C)
thermal expansion (1/C)
density (g/cm^3)
HB (User)
thermal conductivity (W/(m-K))
specific heat (J/(kg-K))
heat capacity (J/(mol-K))
thermal diffusivity (m^2/s)
PS (User)
electrical resistivity (ohm-m)
electrical conductivity (1/(ohm-m))
vapor pressure (Pa)
viscosity (Poise)
elastic modulus (GPa)
shear modulus (GPa)
Poisson's ratio (unitless)
bulk modulus (GPa)
true stress-strain (tension) (MPa)
true stress-strain (compression) (MPa)
hemispherical total emissivity (unitless)
normal total emissivity (unitless)
tensile strength (MPa)
yield strength (tension) (MPa)
yield strength (compression) (MPa)
elongation (%)
fatigue (S-N curve) (MPa)
fatigue (e-N curve) (unitless)
stress-rupture (MPa)
creep strength (MPa)
relative permeability (unitless)
absolute permeability (H/m)
magnetization curve B-H (T)
magnetization curve H-B (A/m)
include
optional
Search/Report Constraints
Temperature (C) 20
Time (h) 10000
Cycles 1.0e+04
Temperature range (C) 10
Magnetic flux - B (T) 1.0
Magnetic field - H (A/m) 1000
Material
dL/L (unitless)
E (GPa)
CTE (1/C)
HB (User)
PS (User)
Chem bonded Furan molding sand - core (fine) 1.6156e-06
Chem bonded shell sand - mold (coarse) 1.4085e-06
Mechanically molded green sand 4.6011e-06
Green sand - high pressure molding sand 1.4415e-05
new steel 4.6882e-03 8.0000e+01 1.9200e+02
Search/Report
Search
Report
Get results
Goto material
Clear all
Close
Search all material types
Replace decimals with commas

Figure 14.

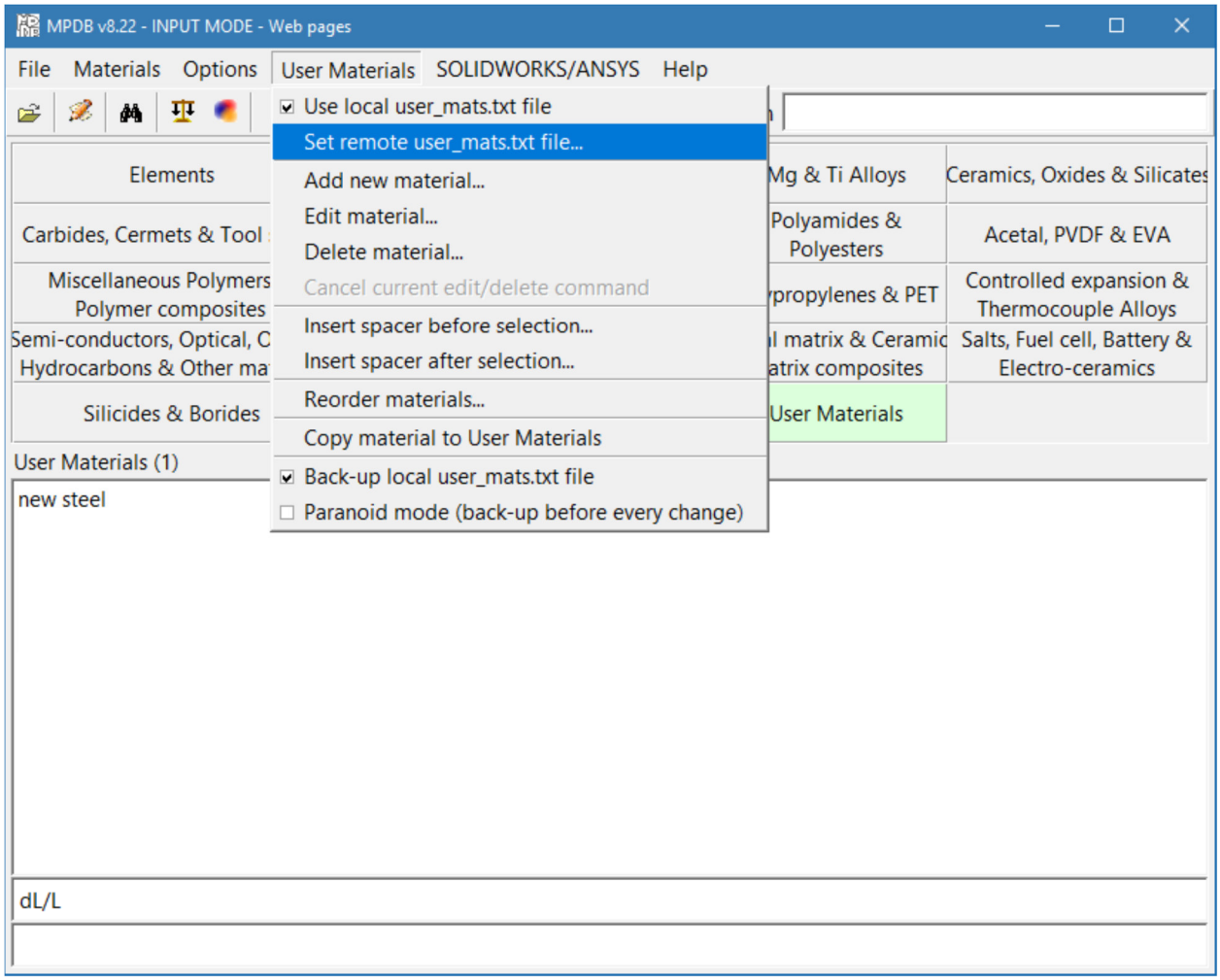
MPDB v8.22 - INPUT MODE - Web pages
File
Materials
Options
User Materials
SOLIDWORKS/ANSYS
Help
Use local user_mats.txt file
Set remote user_mats.txt file...
Add new material...
Edit material...
Delete material...
Cancel current edit/delete command
Insert spacer before selection...
Insert spacer after selection...
Reorder materials...
Copy material to User Materials
Back-up local user_mats.txt file
Paranoid mode (back-up before every change)
Elements
Carbides, Cermets & Tool
Miscellaneous Polymers
Polymer composites
Hydrocarbons & Other ma
Silicides & Borides
Mg & Ti Alloys
Polyamides & Polyesters
ypropylenes & PET
l matrix & Ceramic
atrix composites
User Materials
Ceramics, Oxides & Silicates
Acetal, PVDF & EVA
Controlled expansion & Thermocouple Alloys
Salts, Fuel cell, Battery & Electro-ceramics
User Materials (1)
new steel
dL/L

Figure 15.