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.
- 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)
- I) 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 shortcut 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:
 - 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.

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Elements	Fe & Ni Alloys	AI & 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 & Epoxie	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	_				
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Figure 1.

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	Set remote user_mats.txt file			
Elements	Add new material	Mg & Ti Alloys	Ceramics, Oxides & Silicates	
Carbides Cermets & Tool	Edit material	Polyamides &	Acetal PVDE & EVA	
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	Back-up local user_mats.txt file			
	□ Paranoid mode (back-up before every change)			
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Figure 2.

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Material name: (500 char max)			
Reference: (500 char max)			
Note: (500 char max)			
Properties		Equation Definition	User Fields
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Figure 3.

Label input		
Input text for the label (30 chars m	nax, " and \ are	not allowed)
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Figure 4.

RAdd a new user	r material					×
Material name: (500 char max)	new steel					
Reference: (500 char max)	internal rep	ort #28495				
Note: (500 char max)	vacuum deg	jassed				
Properties	-				Equation Definition	User Fields
Iinear expan	ision (dL/L)	C mean CTE	C thermal expansion	C density	• x-y pairs	# User fields 1 💌
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C electrical res	sistivity	C electrical conductivity	C vapor pressure	C viscosity	C polynominal of In(X)-In(Y) C heat capacity	1
elastic modi	ulus train (tension	shear modulus	Poisson's ratio	bulk modulus	polynominal of In(X)	
C tonsilo stress-s	ath	C viold stress-strain (compressio	C viold strength (compression)	C elemention	The data must be in x-y pairs	
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OK	_	Save Dataset	Save User Fields	Plot Current Data	Clear Current Dataset	Cancel

Figure 5.

Material name: (300 char max) new steel Reference: (300 char max) internal report #28495 Note: (300 char max) vacuum degassed View vacuum degassed © Inser expansion (dL/L) © mean CTE © thermal expansion © density © thermal conductivity © specific heat © linear expansion (dL/L) © mean CTE © thermal diffusivity © electrical resistivity © electrical conductivity © specific heat © heat capacity © linear expansion (dL/L) © mean CTE © thermal diffusivity © polynominal © vapor pressure © itrue stress-strain (tension) © true stress-strain (tension) © true stress-strain (tension) © yield strength (compression) © heinispherical total emissivity © relative permeability © absolute permeability © stress-rupture © relative permeability © absolute permeability © magnetization curve H-H
Reference: (300 char max) internal report #28495 Note: (300 char max) vacuum degassed Properties Equation Definition © linear expansion (dl/L) mean CTE C thermal expansion © linear expansion (dl/L) mean CTE C thermal expansion © lectrical resistivity © gelectrical conductivity C vapor pressure © elastic modulus © shear modulus C heat capacity © true stress-strain (tension) C rue stress-strain (compression) C hemispherical total emissivity © relative permeability © absolute permeability C absolute permeability C recep strength T is KetWin end Hep property it in units of Unitiless
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Figure 9.

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Miscellaneous Polymers & Polymer composites	Elastomers & Epoxies	Minerals, Rocks, Soils & Woods	Polypropylenes & PET	Controlled expansion & Thermocouple Alloys			
Semi-conductors, Optical, Organi Hydrocarbons & Other materials	Solders, Dental & Co Alloys	Resistance & Magnetic Alloys	Metal matrix & Ceramic matrix composites	Salts, Fuel cell, Battery & Electro-ceramics			
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Figure 10.

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Properties								Equatio	on Definition			User Fi	elds	
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OK		Save Dataset		Save User Fie	lds		Plot Current Da	taset			Clear Current Dataset		Cancel	

Figure 11.





III new steel	– o x
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Reference Note User Fields	Display data
just a simple note	Plot data
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Properties	Output format
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C thermal conductivity (W/(m-K)) C specific heat (J/(ka-K)) C heat capacity (J/(mol-K)) C thermal diffusivity (m^2)	(s) C/C++ C Python
C electrical resistivity (ohm-m) C electrical conductivity (1/(ohm-m)) C vanor pressure (Pa) C viscosity (Poise)	C Fortran C Data
C elastic modulus (GPa) C shear modulus (GPa) C poisson's ratio (unitless) C bulk modulus (GPa)	C Abaqus
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- Orientation / Condition	
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void new steel_dl0(double t, int *error, double *value) { (f introduction to the standard f int *error int *er	
/* internal report #28499 */	
/* HB 80: measured in lab 5*/	
/* PS 192 psi: */	
/* just a simple note */	_
*error = 0;	
/* data is in units or unitiess */	
/* convert from degrees keivin to tillese equations 7/	
t = t + 273.15;	-

Figure 13.

🧱 User Materials				- 🗆 X
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) ✓ include □ optional	shear modulus (GPa)	Poisson's ratio (unitless)	bulk modulus (GPa)	-
r true stress-strain (tension) (MPa) □ include □ optional	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) □ include □ optional	fatigue (e-N curve) (unitless)	stress-rupture (MPa)	creep strength (MPa)	-
relative permeability (unitless) └ include └ optional	absolute permeability (H/m)	magnetization curve B-H (T)	magnetization curve H-B (A/m)	-
Search/Report Constraints Temperature (C) 20 Magnetic flux - B (T) 1.0	10000 Cycles 1.0e+04 Magnetic field - H (A/m) 1000	Temperature range (C) 10		
Material	dL/L (unitless) E (GPa) CTE	(1/C) HB (User) PS (User)		<u> </u>
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Search/Report	Get results n all material types	Goto material	Clear all	Close

Figure 14.

MPDB v8.22 - INPUT MODE - V	Neb pages		– 🗆 🗙
File Materials Options	User Materials SOLIDWORKS/ANSYS Help		
🖻 🎉 🛤 🎹 🥌	Use local user_mats.txt file	h [
	Set remote user_mats.txt file	<u> </u>	
Elements	Add new material	Mg & Ti Alloys	Ceramics, Oxides & Silicates
Carbides Cermets & Tool	Edit material	Polyamides &	Acetal PVDE & EVA
	Delete material	Polyesters	Controlled evenesion 9
Polymer composites	Cancel current edit/delete command	propylenes & PET	Controlled expansion & Thermocouple Alloys
Semi-conductors, Optical, C	Insert spacer before selection	I matrix & Ceramic	Salts, Fuel cell, Battery &
Hydrocarbons & Other ma	Insert spacer after selection	atrix composites	Electro-ceramics
Silicides & Borides	Reorder materials	User Materials	
Lines Mathemials (d)	Copy material to User Materials		
User Materials (1)	Back-up local user_mats.txt file		
new steel	□ Paranoid mode (back-up before every change)		
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dL/L			
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Figure 15.