Code_Aster

Version default

Titre : Opérateur DEFI_TRC
Responsable : Renaud BARGELLINI

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Clé : U4.43.04 Révision : 4112

Operator `DEFI_TRC`

1 Drank

To define a diagram TRC (Transformations in Continuous Cooling) of reference for metallurgical computations.

Diagram TRC thus defined is necessary to the characterization of a metallurgical constitutive law to cooling in operator `DEFI_MATERIAU` (key word factor `META_ACIER`).

For the definition of the metallurgical data and the modelization which is made by it, one will refer to the document [R4.04.01].

Product a data structure of the table_TRC `type`.

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2   Syntax

```
name [table_TRC] = DEFI_TRC

(   ♦HIST_EXP  =  _F   (
                ♦VALE=      lval  ,                            [l_R]
                    ),

    ♦    TEMP_MS = _F (
                ♦SEUIL=         zs,                            [R]
                ♦AKM=       akm,                               [R]
                ♦BKM=       bkm,                               [R]
                ♦TPLM=      Vc,                                [R]
                    ),

    ◊GRAIN_AUST   = _F (
                ◊DREF=       C,                                [R]
                ◊A=       have   ,                             [R]
                    ),
)
```

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3 Operands

3.1 Key word HIST_EXP

♦HIST_EXP =

an occurrence of the key word factor HIST_EXP makes it possible to define the evolutions of ferrite, pearlite and bainite associated with a thermal history with cooling and conditions of austenitization given.

3.1.1 Operand VALE

♦VALE = lval

List of values defining the austenitization, the thermal history $T(t)$ and the ferrite evolutions, pearlite and bainite.

The first value is the value of derivative of the function $T(t)$ (i.e. velocity of cooling) when T is worth $700\,°C$.

The second value is the size of grain (i.e. their diameter) resulting from the conditions of austenitization associated with the TRC.

The 6 following values define the thermal history enters AR_3 and TMF (initial temperature of decomposition of austenite in static cooling "quasi -" and temperature of martensitic end of transformation respectively). These values are the respective coefficients of the students' rag processions of degree 0 to 5 such as the polynomial of a nature 5 thus built either the interpolation enters AR_3 and TMF least squares of the function $F(T)$ deduced from the thermal history and such as:
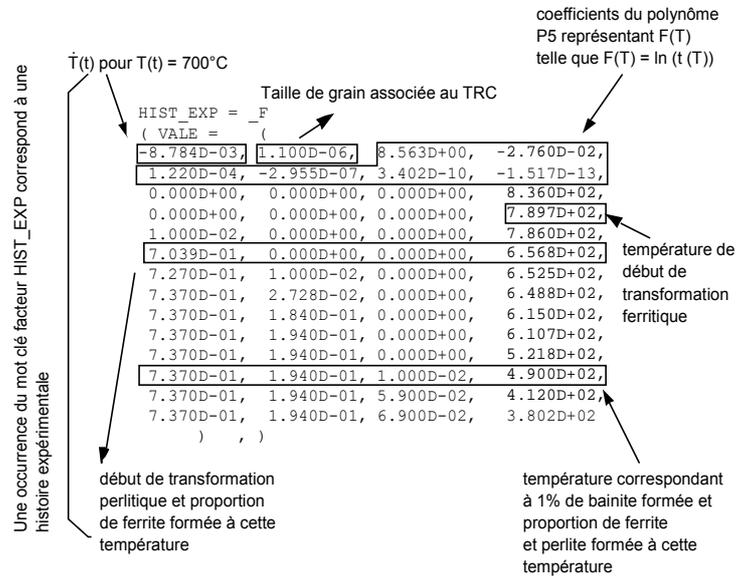
$$F(T) = \ln(t(T))$$

If the experimental thermal history to define is a function closely connected of time (it is - with - to say where the velocity of cooling is constant) one will inform these six values like all equal to zero.

The following values (necessarily by group of 4) define the respective proportions of ferrite, pearlite and bainite present at a temperature given for the experimental thermal history defined by the first 8 values.

The ferritic, perlitic and bainitic transformations associated with a thermal history are defined by all the final proportions of each phase (Z_1 final, Z_2 final, Z_3 final) and the corresponding temperatures, for each transformation with:

- the temperature to which the transformation begins,
- the temperature to which 1% of new phase are formed,
- the temperature to which $Z_{final} - 1\%$ of new phase are formed,
- the temperature to which the transformation is finished (with Z_{final} formed phase).

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All the "points" (Z_1, Z_2, Z_3, T) defining an experimental history thus arise as follows:

coefficients du polynôme
P5 représentant F(T)
telle que F(T) = ln (t (T))

$\dot{T}(t)$ pour T(t) = 700°C

Taille de grain associée au TRC

Une occurrence du mot clé facteur HIST_EXP correspond à une histoire expérimentale

```
HIST_EXP = _F
( VALE =    (
  -8.784D-03,  1.100D-06,  8.563D+00,  -2.760D-02,
  1.220D-04,  -2.955D-07,  3.402D-10,  -1.517D-13,
  0.000D+00,   0.000D+00,  0.000D+00,   8.360D+02,
  0.000D+00,   0.000D+00,  0.000D+00,   7.897D+02,
  1.000D-02,   0.000D+00,  0.000D+00,   7.860D+02,
  7.039D-01,   0.000D+00,  0.000D+00,   6.568D+02,
  7.270D-01,   1.000D-02,  0.000D+00,   6.525D+02,
  7.370D-01,   2.728D-02,  0.000D+00,   6.488D+02,
  7.370D-01,   1.840D-01,  0.000D+00,   6.150D+02,
  7.370D-01,   1.940D-01,  0.000D+00,   6.107D+02,
  7.370D-01,   1.940D-01,  0.000D+00,   5.218D+02,
  7.370D-01,   1.940D-01,  1.000D-02,   4.900D+02,
  7.370D-01,   1.940D-01,  5.900D-02,   4.120D+02,
  7.370D-01,   1.940D-01,  6.900D-02,   3.802D+02
         )   ,  )
```

température de début de transformation ferritique

début de transformation perlitique et proportion de ferrite formée à cette température

température correspondant à 1% de bainite formée et proportion de ferrite et perlite formée à cette température

3.2   Key word TEMP_MS

♦TEMP_MS

This key word factor makes it possible to define the law of evolution of the temperature Ms according to the quantities of ferrite, pearlite and bainite already formed according to the model:

$$Ms = Ms0 \qquad\qquad\qquad\qquad \text{si} \quad Z_1 + Z_2 + Z_3 \leq \text{SEUIL}$$
$$Ms = Ms0 + AKM(Z_1 + Z_2 + Z_3) + BKM \quad \text{si} \quad Z_1 + Z_2 + Z_3 > \text{SEUIL}$$

where $Ms0$ is the "classical" temperature of martensitic beginning of transformation when this one is total (it is defined under the key word factor META_ACIER of DEFI_MATERIAU.

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3.2.1 Operand SEUIL

♦SEUIL =zs   ,

z_s is the quantity of austenite transformed into decaf of which Ms is invariant.

3.2.2 Operand AKM

♦AKM   =akm   ,

akm is the factor of proportionality between the reduction in the temperature Ms and the quantity of transformed austenite $(Z_1 + Z_2 + Z_3)$.

3.2.3 Operand BKM

♦BKM   =bkm   ,

bkm is the Y-coordinate at the origin of the equation closely connected connecting the reduction in Ms to the quantity of transformed austenite.

3.2.4 Operand TPLM

♦TPLM =Vc   ,

Vc is the velocity of cooling to $700\,°C$ the experimental history slowest, which makes it possible to form a little martensite.

These four keywords define the values of the quantities $SEUIL, AKM, BKM$ intervening in the law of evolution of Ms which one supposes independent of the size of grain.

3.3 Key word GRAIN_AUST

Makes it possible to define the influence of the size of grain on the metallurgical transformations in cooling defined by diagram TRC.

3.3.1 Operand DREF

◊DREF=   C,

do is the size of grain (i.e. its diameter) associated with the diagram defined under the key word factor HIST_EXP.

3.3.2 Operand A

◊A=   has   ,

a is a material parameter which makes it possible to characterize the effect of the size of grain on diagram TRC of a steel (cf [R4.04.01]).