Operator DEFI_TRC

1 Goal

To define a diagram TRC (Transformations into Continuous Cooling) of reference for metallurgical calculations.

The diagram TRC thus defined is necessary to the characterization of a metallurgical law of behavior to cooling in the operator `DEFI_MATERIAU` (keyword factor `META_ACIER`).

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

Product a structure of data of the type `table_TRC`.

2 Syntax

```
name [table_TRC] = DEFI_TRC

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

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

      ◊  GRAIN_AUST = _F (
                ◊  DREF   = C,                                  [R]
                ◊  With   = has   ,                                  [R]
                      ),
    )
```

3 Operands

3.1 Keyword `HIST_EXP`

♦ `HIST_EXP =`

An occurrence of the keyword factor `HIST_EXP` allows 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 evolutions of ferrite, pearlite and bainite.

The first value is the value of the derivative of the function $T(t)$ (i.e. the speed 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 within the meaning of least squares of the function $F(T)$ deduced from the thermal history and such as:

$$F(T)=\ln(t(T))$$

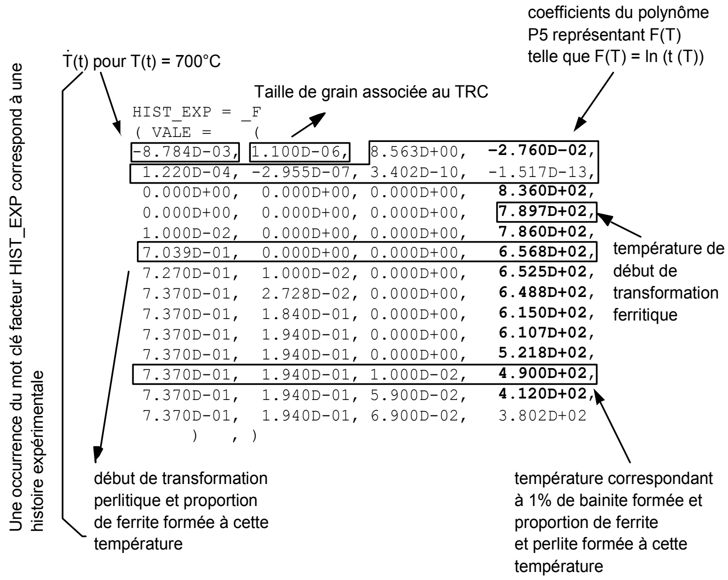
If the experimental thermal history to define is a function closely connected of time (it is - with - to say where the speed of cooling is constant) one will inform these six values like all equal to zero.

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 the whole of the final proportions of each phase (Z_1 final, Z_2 final, Z_3 final) and 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} of formed phase).

The whole of the “points” $(Z_{1,}Z_{2,}Z_{3,}T)$ defining an experimental history thus presents itself as follows:



3.2 Keyword TEMP_MS

♦ TEMP_MS

This keyword 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 law:

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

where $Ms0$ is the “classical” temperature of martensitic beginning of transformation when this one is total (it is defined under the keyword factor META_ACIER of DEFI_MATERIAU.

3.2.1 Operand THRESHOLD

♦ `THRESHOLD = 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 quantity of transformed austenite $(Z_1+Z_2+Z_3)$.

3.2.3 Operand BKM

♦ `BKM = bkm,`

bkm is the ordinate at the origin of the equation closely connected connecting the reduction in Ms with the quantity of transformed austenite.

3.2.4 Operand TPLM

♦ `TPLM = Vc,`

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

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

3.3 Keyword GRAIN_AUST

Allows 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 keyword factor `HIST_EXP`.

3.3.2 Operand With

◊ `With = has ,`

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