

V: speed of mobility of dislocations.

ΔH_i : Enthalpy of activation of a dislocation at temperature

T.

This speed of dissipation and is measure a purs grains

(Exp: Fe) in our case this velocity will depend enormously on the impurities in the grains namely the existence of the addition elements in gap or carbides by a zone of the matrix.

6. CONCLUSION

Following the application of a previously defined heat treatment protocol, the optical microscopy analysis of the morphology and that by x-ray diffraction of the microstructure, of the different zones of the weld seam of the X70 steel, have showed a clear variation of the microstructure by formation and / or dissolution of carbides and nitrides according to the type of heat treatment applied.

The stripping of all the diffractograms, informs us well on the formation and the dissolution of the different phases which can coexist, following a defined heat treatment. For example, one can quote the made of the TiC and NbC phases which form at 650 °C. for a hold time of two hours, whereas at 550 °C. These precipitates dissolve; and that the AlNb₃ phase is formed by backscattering effect of the Nb and Al element in solution in the matrix.

Supplied energy in the form of controlled heat treatments leads to thermodynamically stable systems along the formation and / or dissolution of the phases, which is accompanied by the dissipation of internal stresses, initially introduced by the effect of cooling less or slower of the weld seam. The dissipation of internal stresses (dislocations in the grains or inter granular) which is accompanied with the formation and / or dissolution of carbides and nitrides leads to fluctuations in hardness measurements of X70 steel.

REFERENCES

- [1] BATH E. (1968). Metallurgical determinants mechanical properties.
- [2] Yu H, Sun Y, Chen QX, Jiang HT, Zhang LH. (2006). Precipitation behaviors of acicular ferrite X70 pipeline steel. *Materials Science and Engineering* 18(3): 309-313. <https://doi.org/10.1007/s12613-011-0439-4>
- [3] Gladman T. (1966). *Proceedings of the royal society*.
- [4] Constant A, Grumbach M, Blood G. (1970). Study of the transformation of the austenite and changes the properties of steels at dispersoids. *Metallurgy Review*.
- [5] Gladman T, Dulieu D, Magwor ID. (1975). Structure property relationship ships in High strength microalloyed steels. *Microalloying75*, Washington.
- [6] Creusot L. (1971). Study of the Influence of Aluminium. Days' ECSC information, Luxembourg.
- [7] CSM. (1971). Study of the influence of niobium. ECSC information days Luxembourg.
- [8] NORME API 1104. (september 1999)19 edition.
- [9] Gladman T. (1966). *Proceedings of the Royal Society*.

- [10] Beguinot J, Palengat R, Blondeau R, Dollet J. (1978). Influence of the precipitation state of the vanadium on the mechanical properties of steels aluminum-killed. Days of special steels, Saint-Etienne.
- [11] Sage AM, Hayes DM, Earley CC, Almond EA. (1976). Effects of some variations in composition on mechanical properties of controlled-rolled and normalized vanadium steel 12mm plates. *Metals Technology* 293-302. <https://doi.org/10.1179/030716976803392213>
- [12] Civallero M, Parrini C. (1971). Lamination controlled steels dispersoids for the production of medium-sized sheets of high strength and high toughness. CIT CSD.
- [13] Bridge G, Maynier P, Dollet J, Bastien P. (1970). Contribution to the study of the influence of molybdenum on the softening of activation energy income. *Metallurgical News*.
- [14] Lewellym DT, Cook WT. (1974). Metallurgy of boron-tread low-alloy steel. *Metals Technology* 517-529. <https://doi.org/10.1179/030716974803287924>
- [15] Bordbar S, Alizadeh M, Hashemi SH. (2013). Effects of microstructure alteration on corrosion behavior of welded joint in API X70 pipeline steel. *Materials and Design* 45: 597-604. <https://doi.org/10.1016/j.matdes.2012.09.051>
- [16] Ling ZQ, Fang J, Zhou Y, Yuan ZX. (2012). Influence of quenching on-line on properties of X70 steel for sour service seamless pipe. *International Conference on Future Energy, Environment, and Materials. Energy Procedia* 16: 444-450. <https://doi.org/10.1016/j.egypro.2012.01.072>

NOMENCLATURE

HSLA	High Limit of Elasticity
WMZ	weld metal zone
HAZ	heat affected zone
MB	Metal base
XRD	X-ray diffraction
Mr	maximum resistance
Er	elastic resistance
Al	Aluminum
Nb	Niobium
Ti	Titanium
C	Carbide.
NC	Carbonitride
V	Vanadium
Fe ₃ C	cementite
V	speed of mobility of dislocations.
ΔH_i	Enthalpy of activation
T	temperature
$\sum_i^n Q_i$	All the energies of the point and linear defects
HV	Hardness vickers
A	has the inner part of the weld
B	presents the central part of the weld.
C	presents the outer part of the weld.