

Rodolfo Pérez dans l'Equipe **Réactivité et Interfaces**

## 'CPR Precipitation'

research program (CNRS – Arcelor – Pechiney/Alcan – CEA)

**Poste rouge du CNRS**

**Cinétiques de diffusion et précipitation dans les  
aciers au niobium**

**Objectives:** Study of the diffusion process applied to the formation and precipitation of NbC in Nb steels.

In particular, compare the diffusion and the reaction-diffusion process in pure Fe and ferrite with different amounts of C.

# 1- Measurement of diffusion coefficient of Nb in Fe and ferrite

**Objective:** \* Analyze the influence of the ferromagnetism in the diffusion of pure Fe between 450 and 650 °C.  
\* Study the variation of D with the amount of C at 650 °C (Nb solubility expected of 1ppm).

**What is done:** Diffusion samples were prepared by ion implantation of 0.5 % of Nb at 20 nm depth.

**What must be done:** Diffusion annealings.

Determination of the diffusion profiles by SIMS

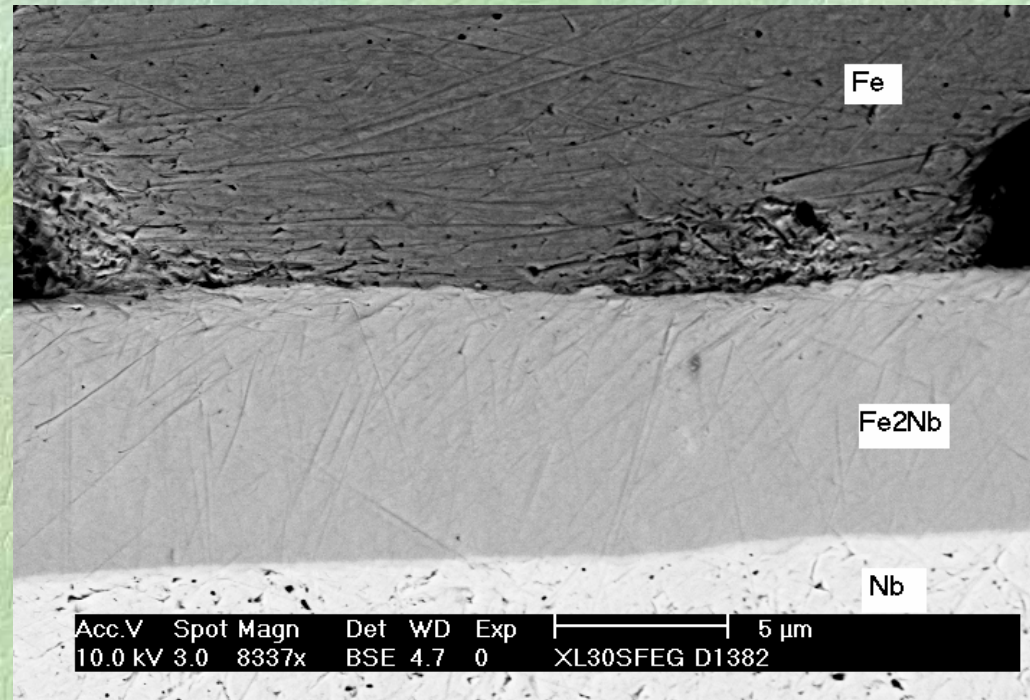
## 2- Reaction-diffusion between bulk ferrite-Nb-Fe

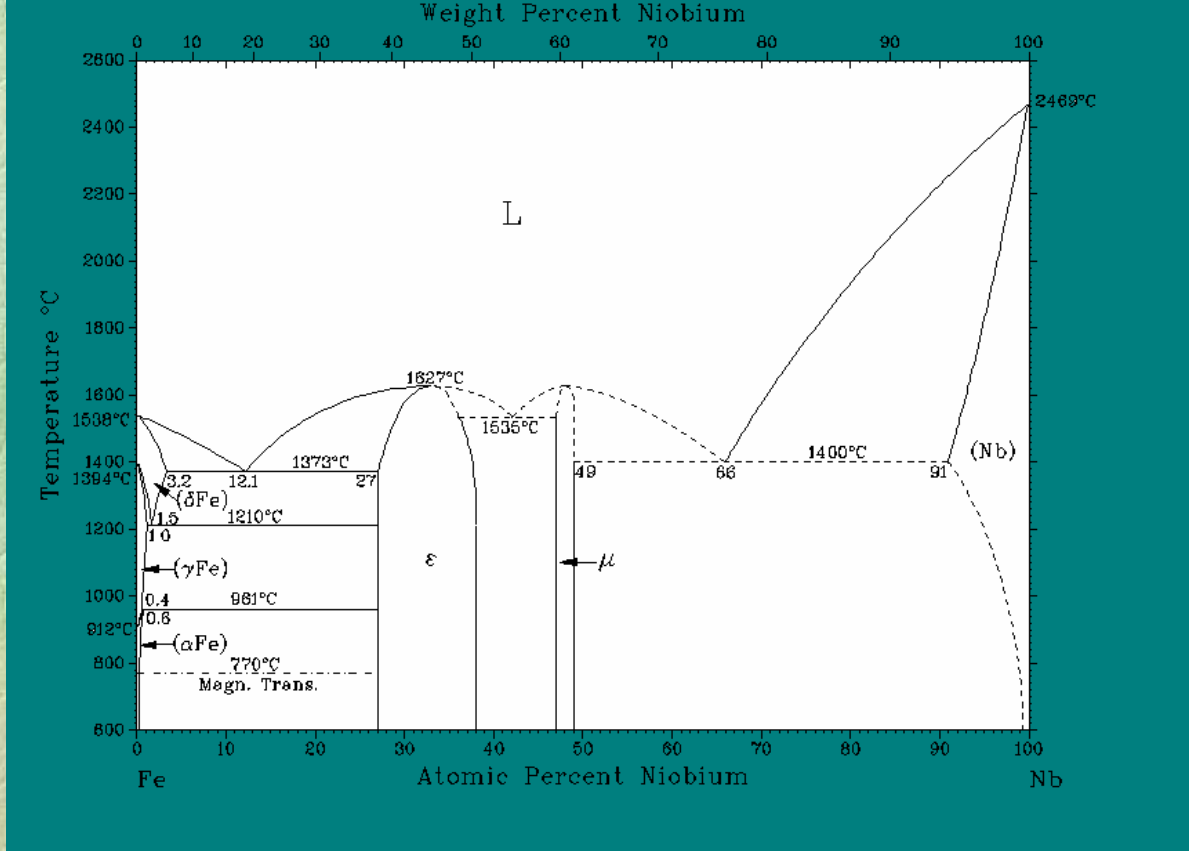
**Objective:** \*Establish the number, the composition and the kinetic of the phase formation in each system.  
\* Compare the process in the Fe-Nb interface with the ferrite-Nb one.

**What is done:** bulk couples were study at 853, 891 and 940 °C.

Only one phase ( $\epsilon$  close to  $\text{Fe}_2\text{Nb}$ ) is observed at both interfaces.

The thickness in the Fe-Nb is 2.2 times higher than in the ferrite-Nb interface.





Why the FeNb ( $\mu$ ) phase do not appears?

Why the presence of C decrease the thickness?

- \* Repeat the process at different times in order to establish the cinematic of each system.
- \* Perform the study at other temperatures to get the activation energy.

### 3- Reaction-diffusion in thin films of Nb-Fe

**Objective:** \* Analyze the composition and the kinetic of the phase formation in the system.  
\* Compare these results with the bulk ones.

**What is done:** Preliminary measurements of resistivity and XRD, reaction happen above 600 °C.

**What must be done:** \* New thin films of Nb-Fe over a quartz substrate.  
\* Resistivity, XRD and differential calorimetry.