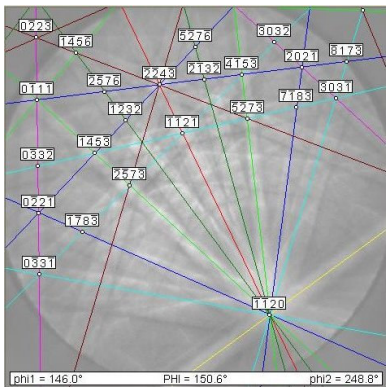
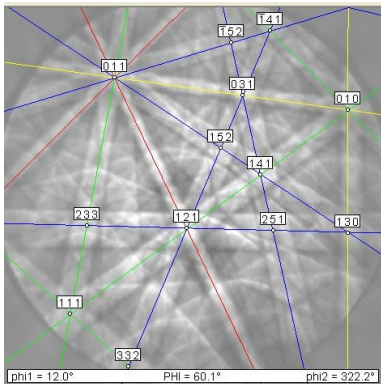
Identification of ε martensite in Fe-based shape memory alloys by means of EBSD

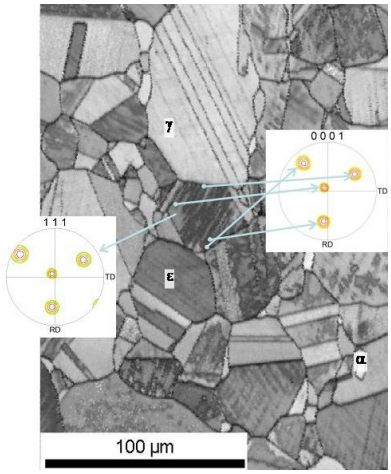
K. Verbeken[1,2,*], N. Van Caenegem[1] and D. Raabe[2]

[1]Department of Metallurgy and Materials Science, Ghent University, Technologiepark 903, B-9052 Ghent, Belgium.
[2]Microstructure Physics, Max-Planck-Institut fur Eisenforschung, Max-Planck-Strasse 1, 40237 Düsseldorf, Germany
* Postdoctoral Fellow of the Research Foundation - Flanders

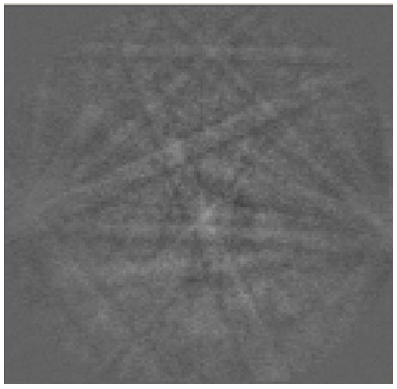


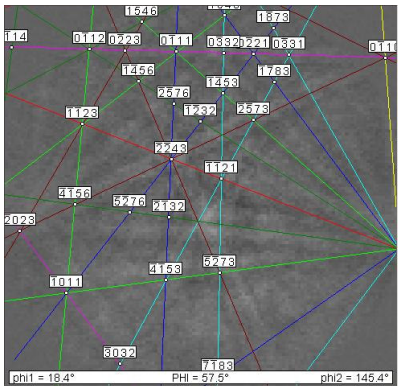


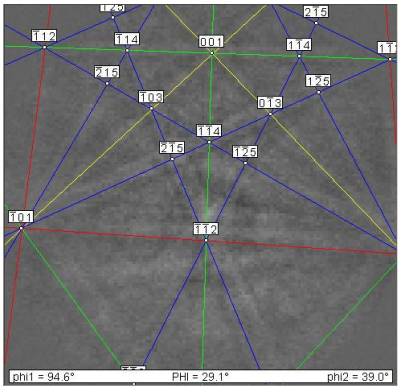
Perfectly indexable patterns can be obtained despite the specific nature of ε martensite. Diffraction pattern on the left shows an indexed ε martensite pattern (CI=0.869). Neither γ (CI=0.036), neither α (CI=0.048) are a valuable alternative. Diffraction pattern on the right shows an indexed γ pattern (CI=0.952). Neither ε (CI=0.000), neither α (CI=0.048) are a valuable alternative. High quality indexing most probably related with high amount of phase in the diffracting volume.



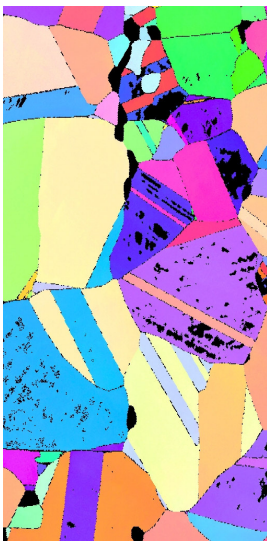
4 different ε martensite variants could be identified in 1 γ grain.



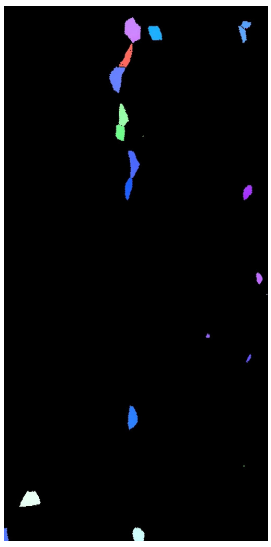




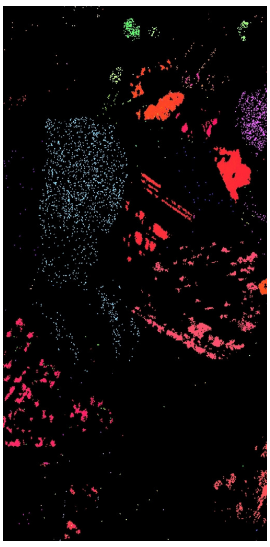
The presence of a good quality diffraction pattern (left) not always guarantees a good indexation. Present case show the possibility of a double identification: i.e. as ε martensite (middle - CI=0.167), as austenite (right - CI=0.167). This is most probably related to the presence of similar amounts of both phases in the diffracting volume.



γ: CI>0.2

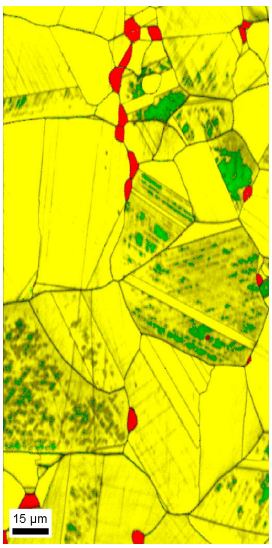


α: CI>0.2



ε: CI>0.2

'Dual' identification will affect the correctness of the quantification of the ε martensite. Recalculations (figures left) of the data give a clue on the correctness of previously (K. Verbeken et al., M.Sc.Eng.A, accepted) obtained results. HRSEM and HRTEM should provide also more information on a possible interpretation of the locally lower IQ factor (figure right) of austenite: is this γ distorted by volume changes or is this an indication of the presence of a low fraction of ε that remains undetectable?



IQ+Phase map