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## Influence of the ratio and direction of compression on the corrosion behaviour of plastically deformed iron-based alloys

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The shaping by plastic deformation (forging, stamping ...) necessarily leads to strongly increased dislocation densities in alloys. This may induce noticeable changes in their mechanical properties as well as for their behaviour in corrosion. A lot of works have been realized for several decades about the dependence of the corrosion behaviour and the plastic strain. Unfortunately, although it was often concluded that plastic deformation tends to accelerate corrosion [1], the reported observations are rather variable.

Stainless steels having been subjected to cold-working were among the first concerned by such studies, this for solutions as sulphuric acid [2], other acids with or without corrosion inhibitors [3] or solutions containing chlorides [4]. More recently works have been also carried out about cold-rolled Ti-based alloys in contact with solutions of sulphuric acid [5] or with other oxidant solutions such as the Ringer's one [6], alloys based on Al [7] or Mg [8] ...

In the present work steels are considered again, in a simple sulphuric acid solution (H<sub>2</sub>SO<sub>4</sub> 2N) too, but in particular conditions possibly leading to a better control of the samples (simple uni-axial plastic deformations by compression, samples issued from a same ingot of pure iron and from a same ingot of a ternary Fe-18Cr-10Ni alloy (the chemical compositions are thus simple and constant), and taking into account the orientation of the characterized surfaces with respect to the deformation axis.



Despite that the elaboration mode and the sample preparation were conceived and carefully realized, it appeared that there are globally no clear dependence of the different electrochemical parameters characterizing the corrosion behaviour, for the active state, for the change-over of the active state to the passive state, and finally for the passive state. This can be maybe due first to a dependence on the plastic deformation rate and on the orientation with respect to the deformation axis which leads to variations of the same order of magnitude as the lack of reproducibility, and second, especially concerning the possible effect of orientation, that the elaboration procedure, characterized by a radial growth towards the future sample axis during solidification, may induce itself effects on the orientation-dependence of plastic deformation and then on the corrosion behaviour, or even directly on the orientation dependence of this corrosion behaviour, as suggested by the differences sometimes noted for the two orientations for the not deformed samples. Nevertheless a small number of potentially interesting observations were done, concerning for example the effect of both the plastic deformation rate and the orientation on the polarization resistance and open circuit potential during the first 25 minutes following immersion, or the tendency to passive in case of no or low deformation by comparison with higher deformed states.