

AKADEMIA GÓRNICZO-HUTNICZA
IM. STANISŁAWA STASZICA W KRAKOWIE

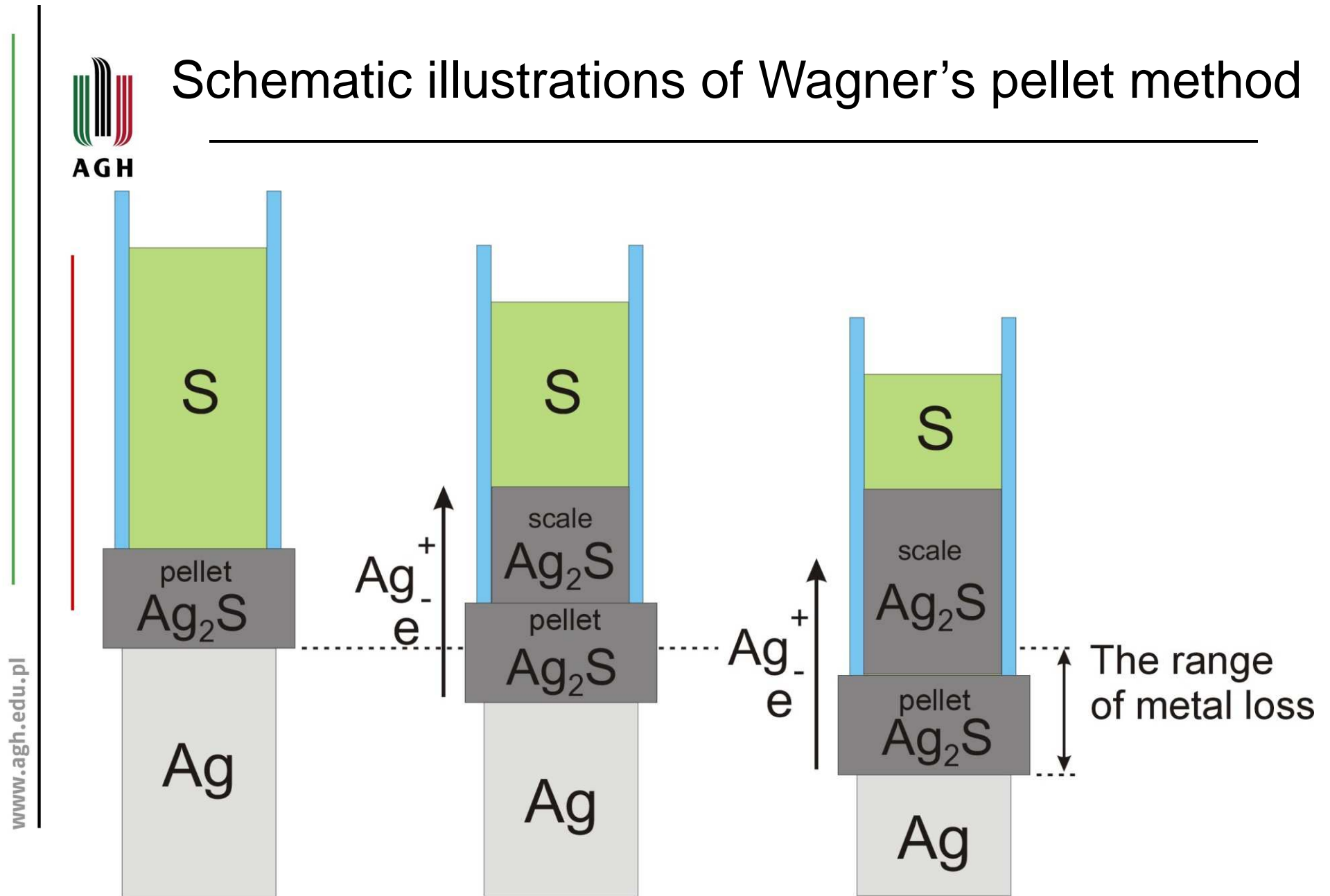
AGH UNIVERSITY OF SCIENCE
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DISSOCIATION MECHANISM OF SCALE GROWTH ON METALS

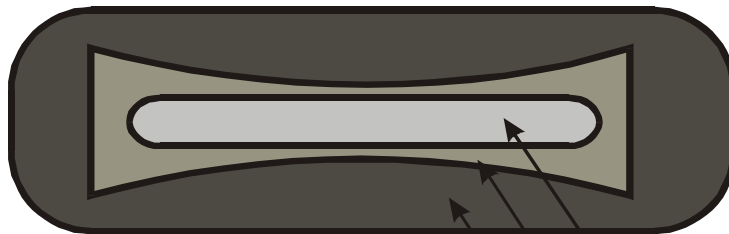
<http://home.agh.edu.pl/~grzesik>

Schematic illustrations of Wagner's pellet method

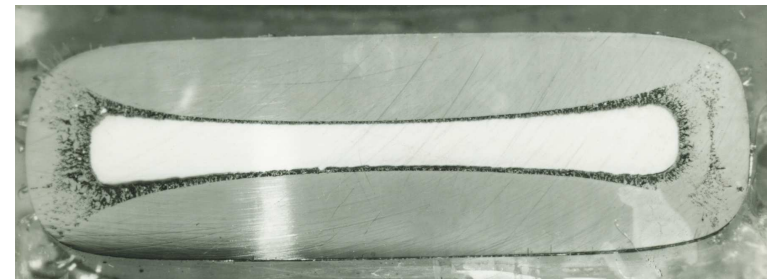
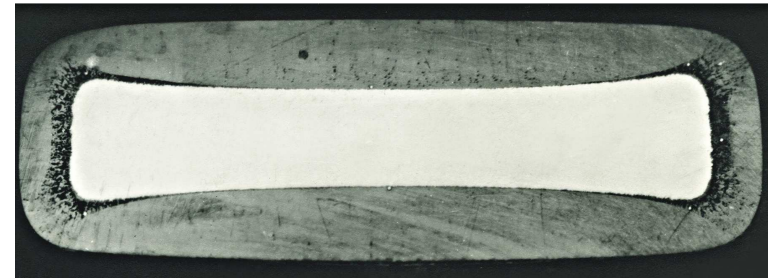


Influence of edges on scale morphology

schematic illustration

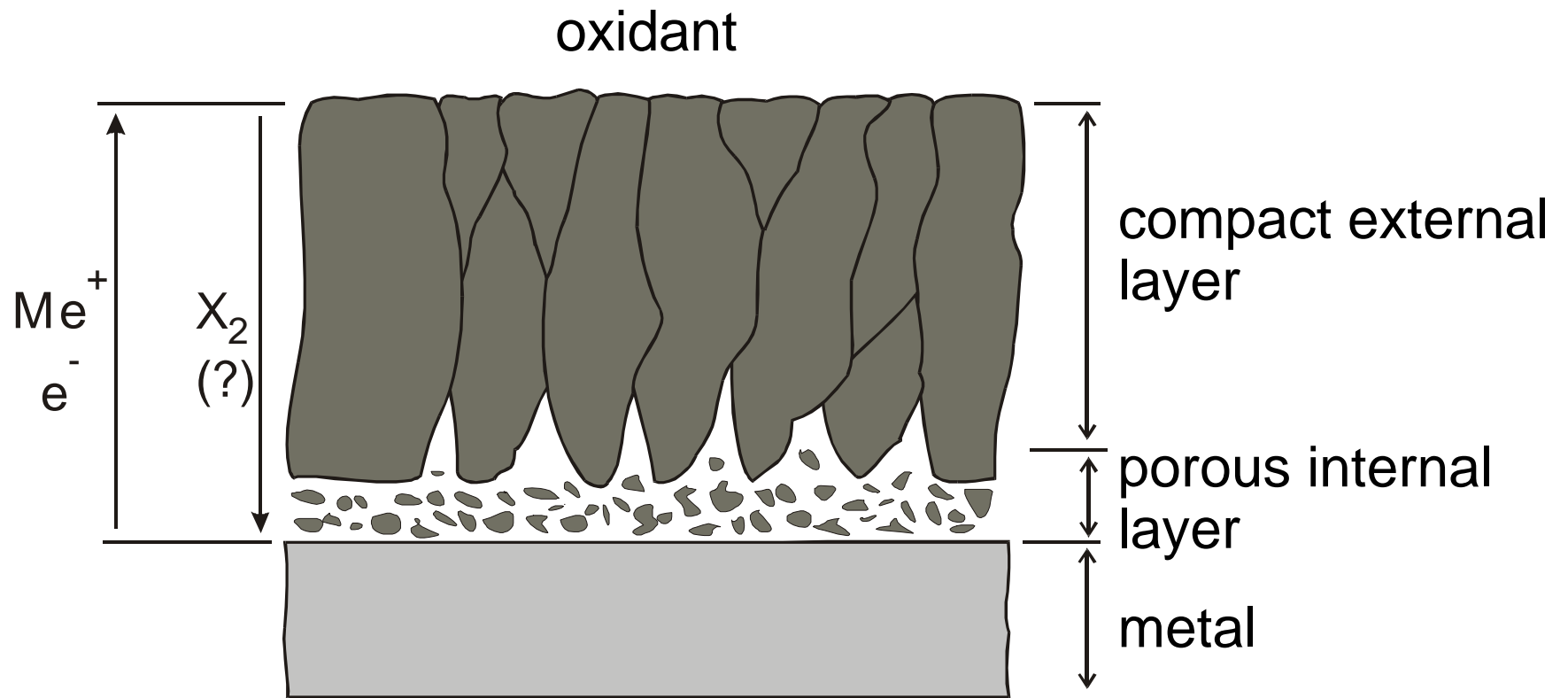


Ag-Ag₂S-S₂



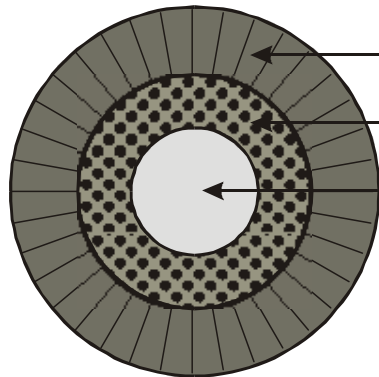
metallic core
porous internal layer
compact external layer

Morphology of scales formed due to outward metal diffusion

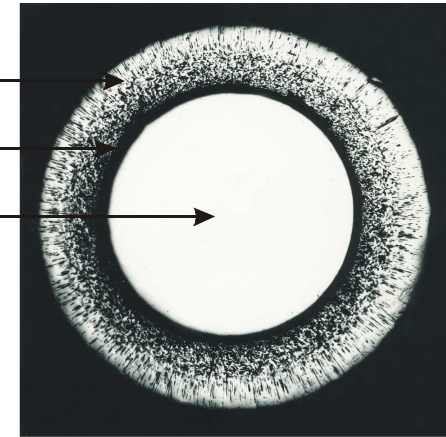


Morphology of scales formed on sample in the shape of cylinders

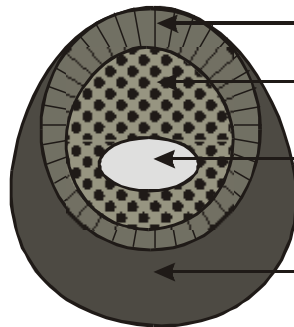
SULFIDATION IN VERTICAL POSITION



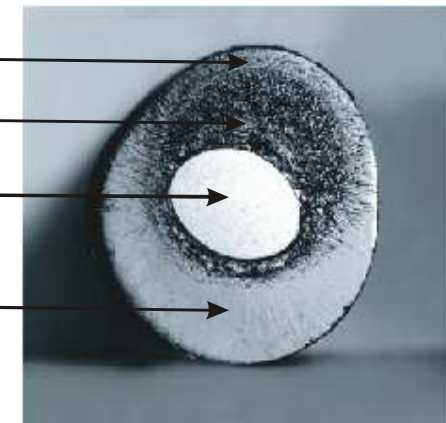
porous external layer
porous internal layer
metallic core



SULFIDATION IN HORIZONTAL POSITION

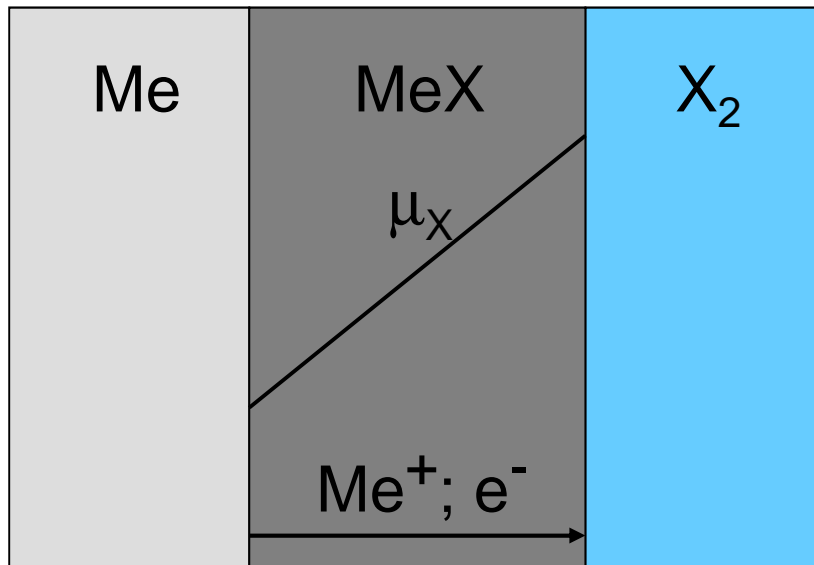


porous intermediate layer
porous internal layer
metallic core
compact external layer

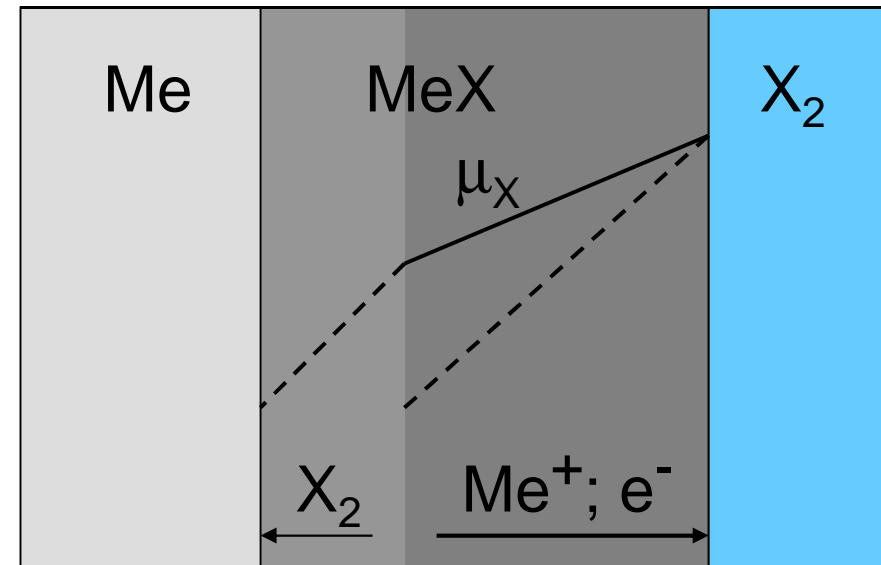


Schematic illustration of the dissociation mechanism of scale formation on metals

Single-phase scale



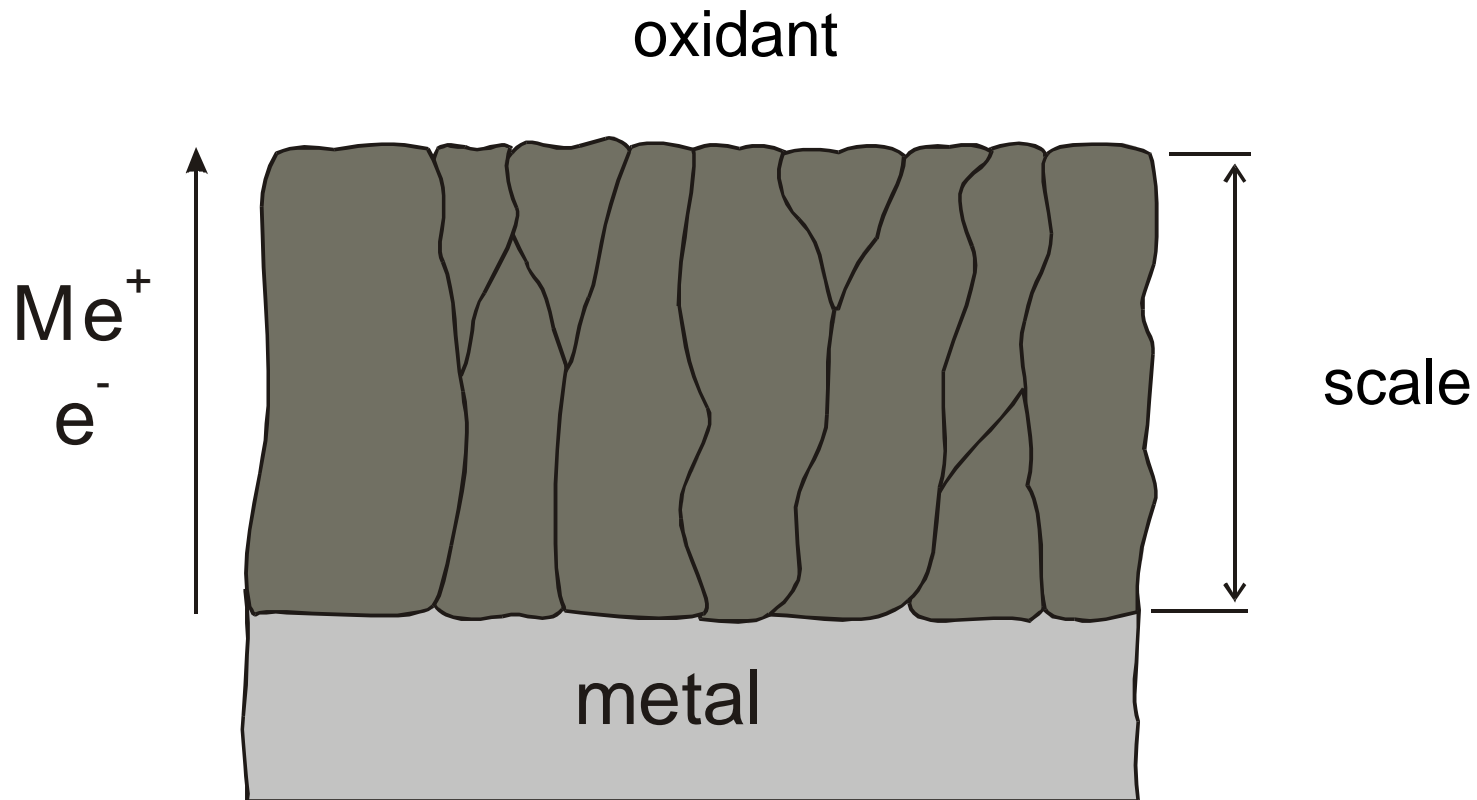
Two-phase scale



Schematic illustration of the dissociation mechanism of scale formation on metals



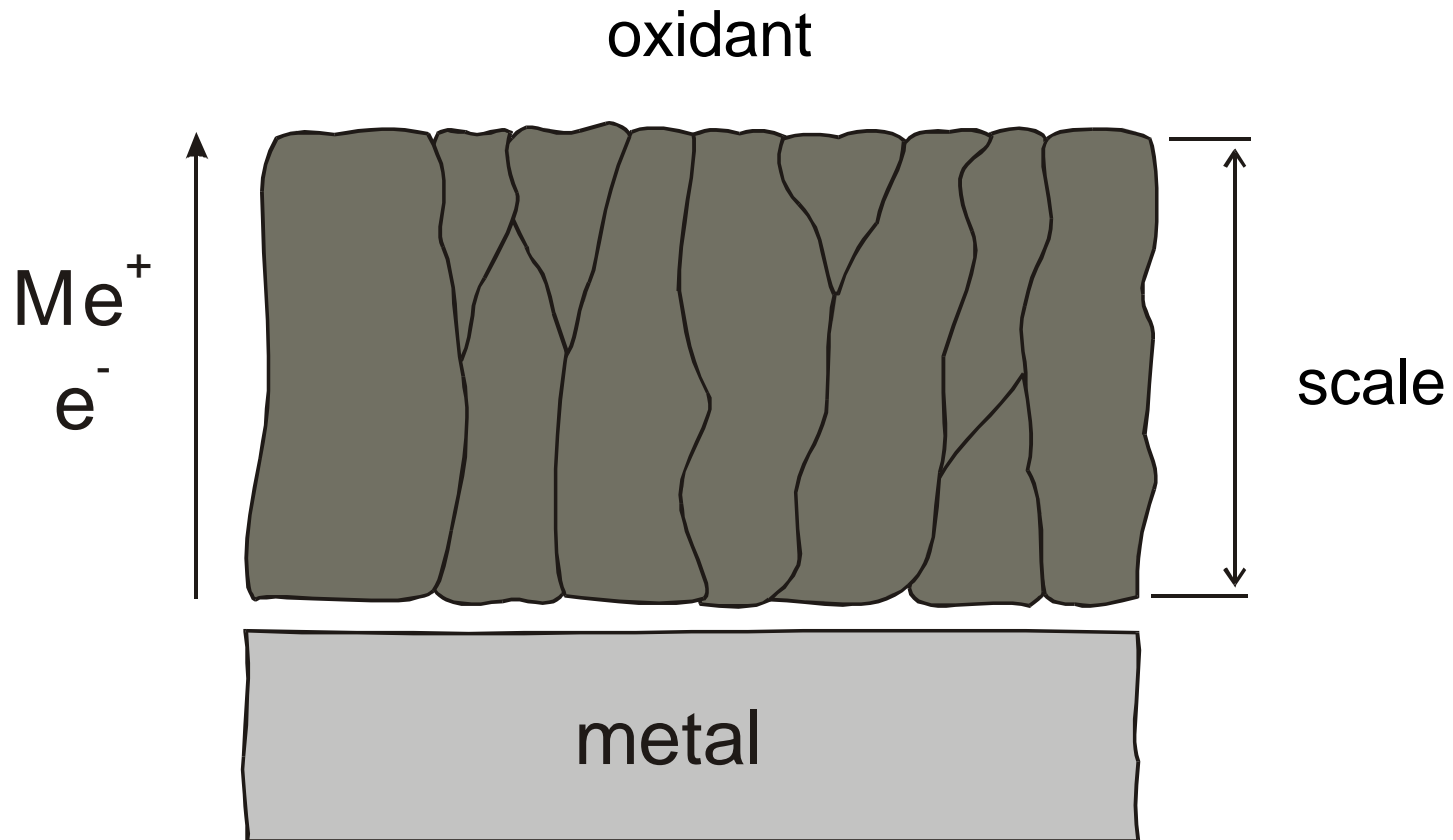
Stage I:



Schematic illustration of the dissociation mechanism of scale formation on metals



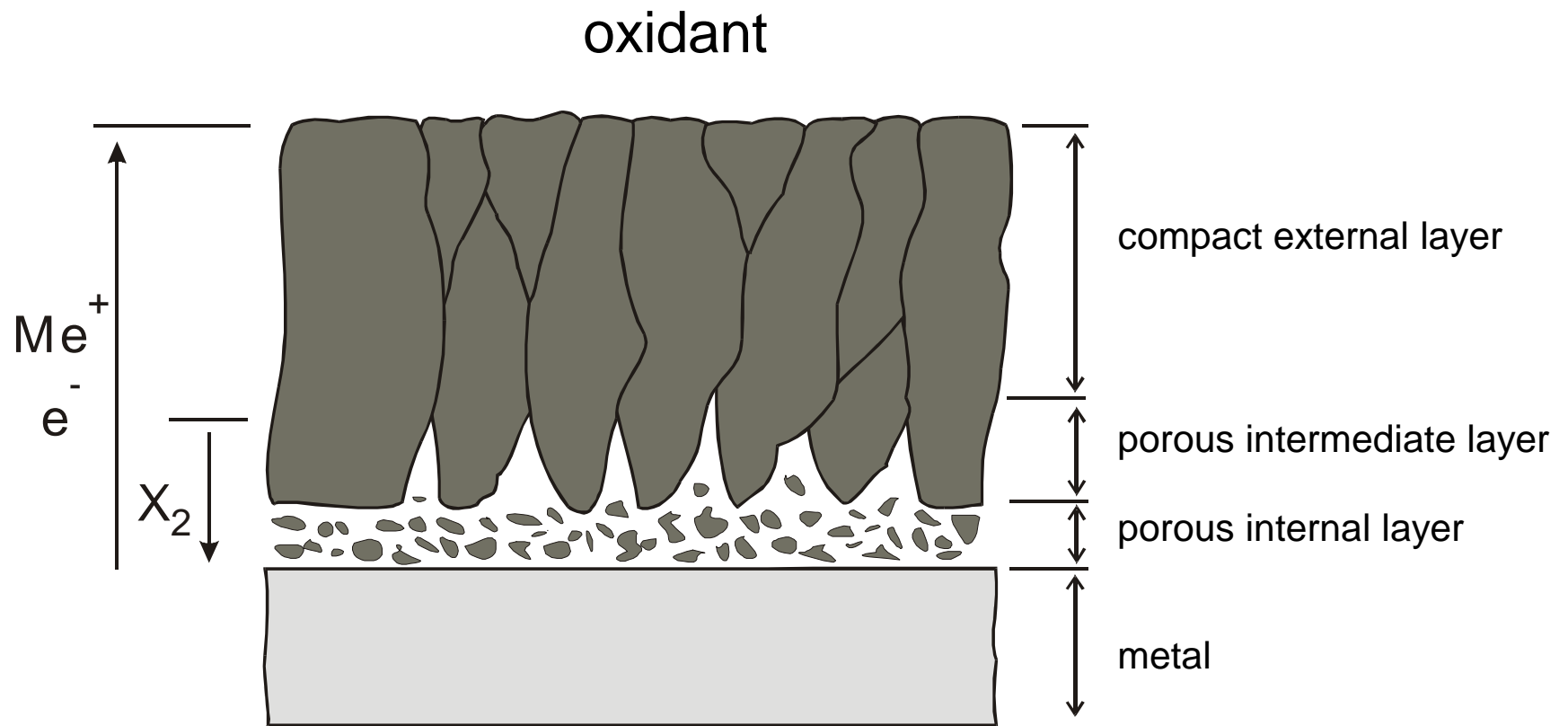
Stage II:



Schematic illustration of the dissociation mechanism of scale formation on metals



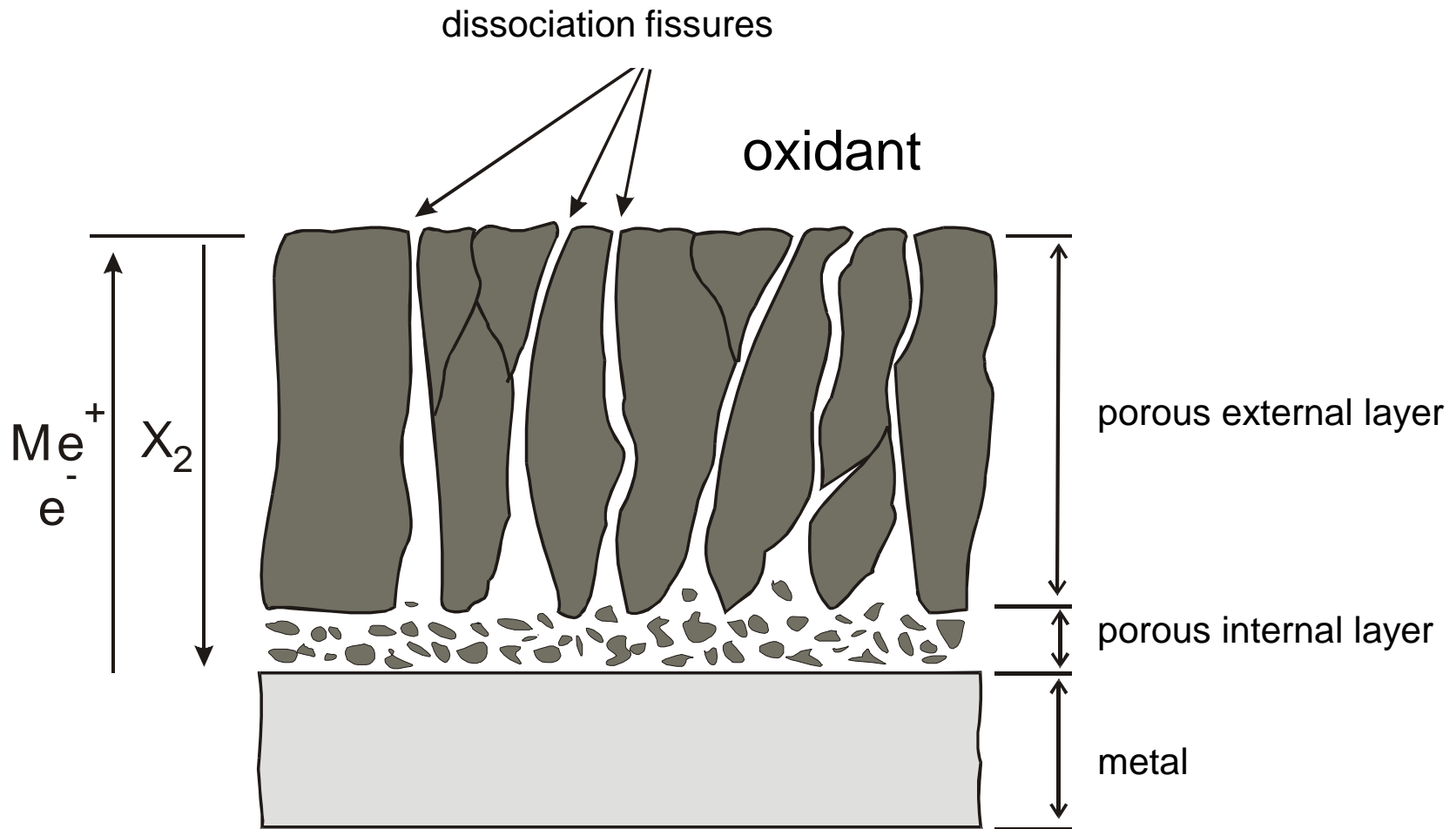
Stage III:



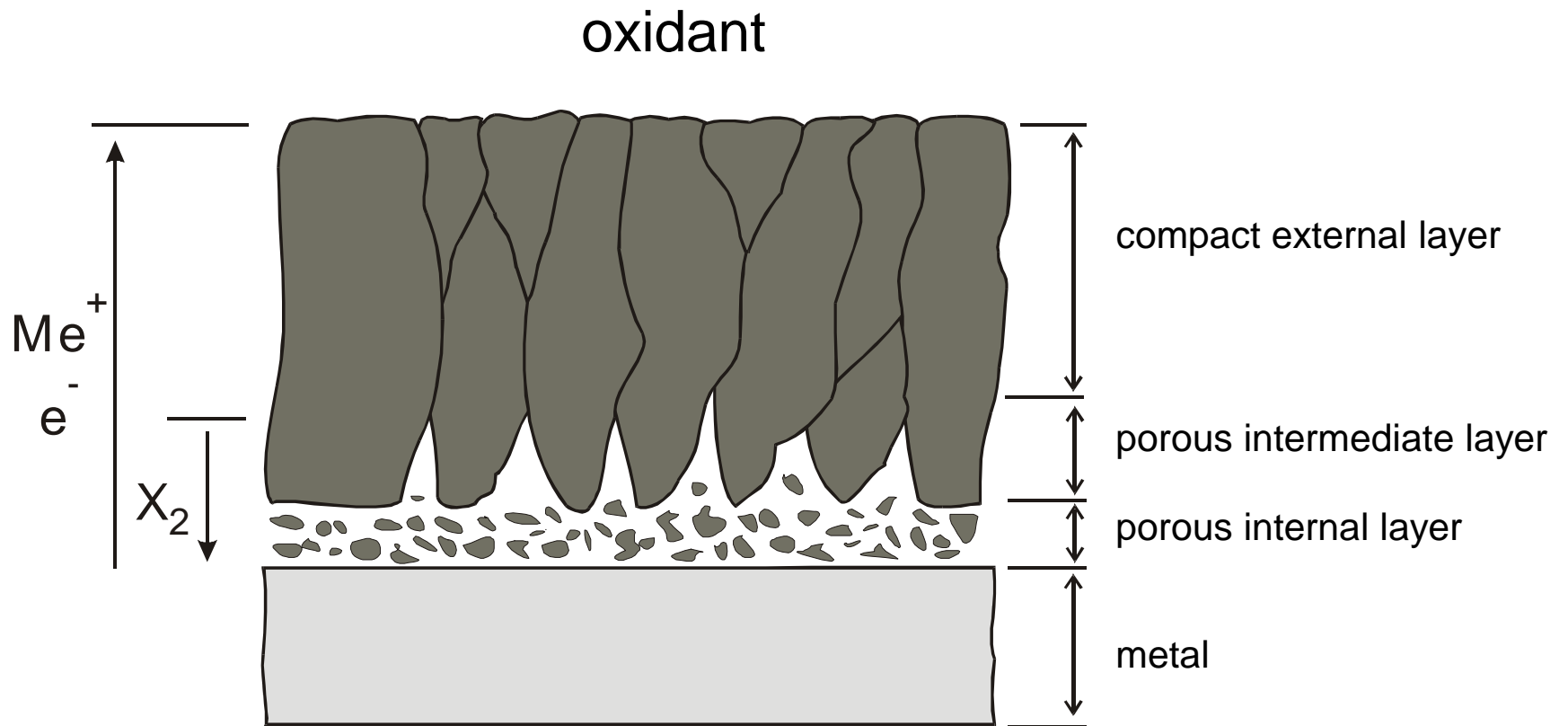
Schematic illustration of the dissociation mechanism of scale formation on metals



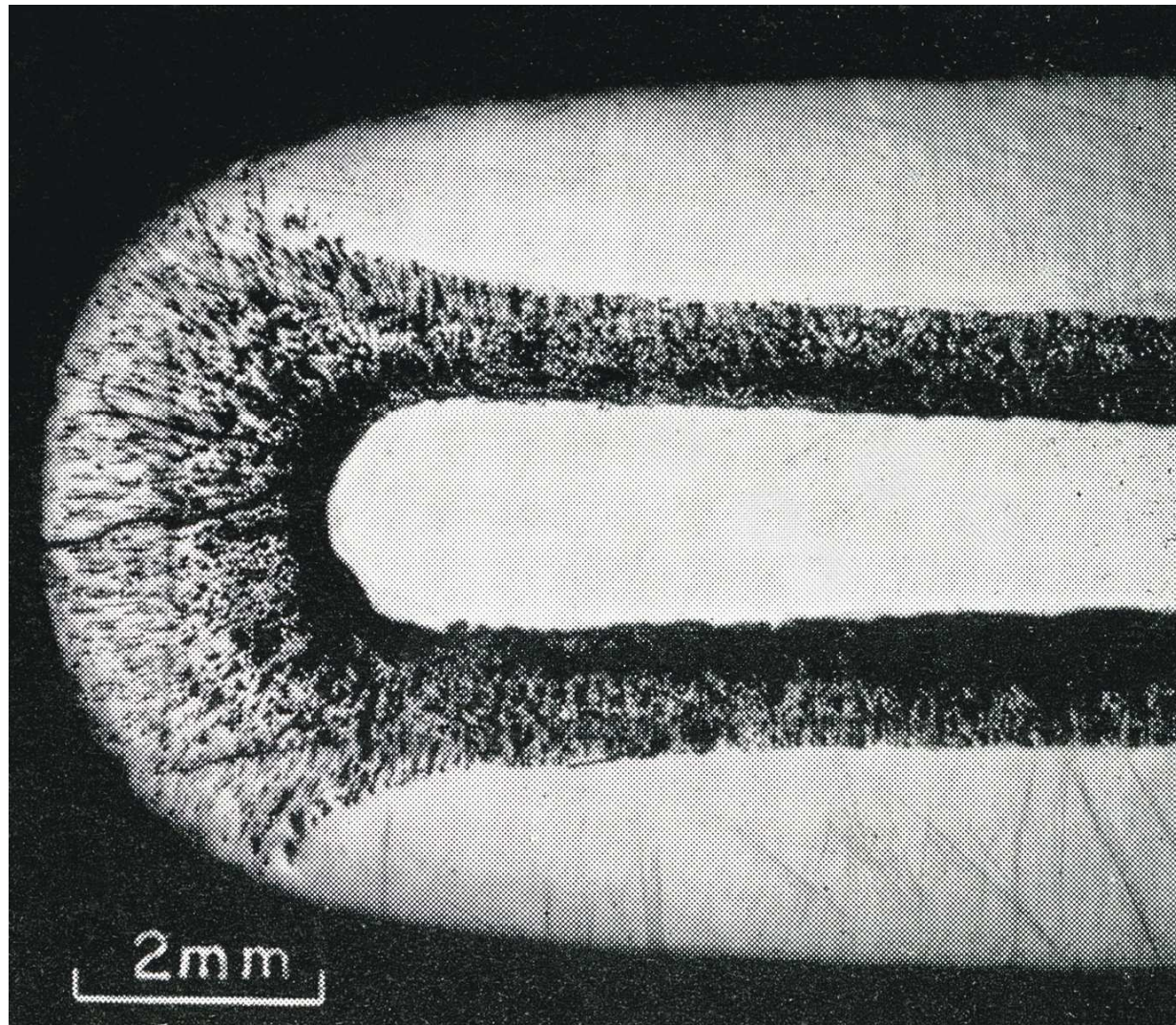
Stage IV:



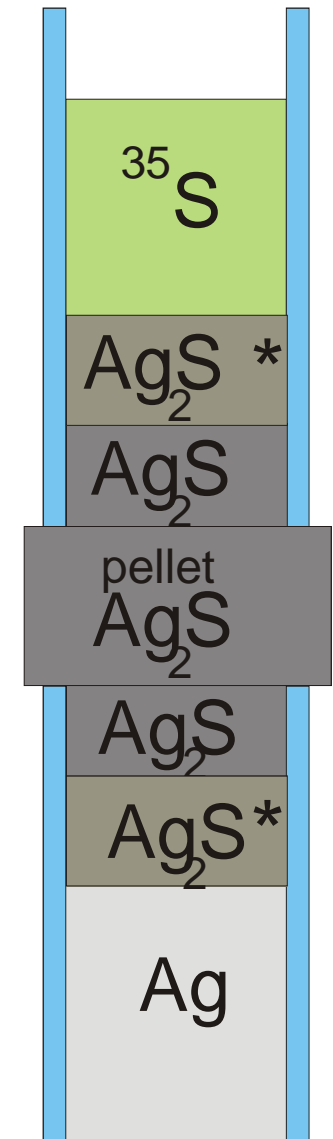
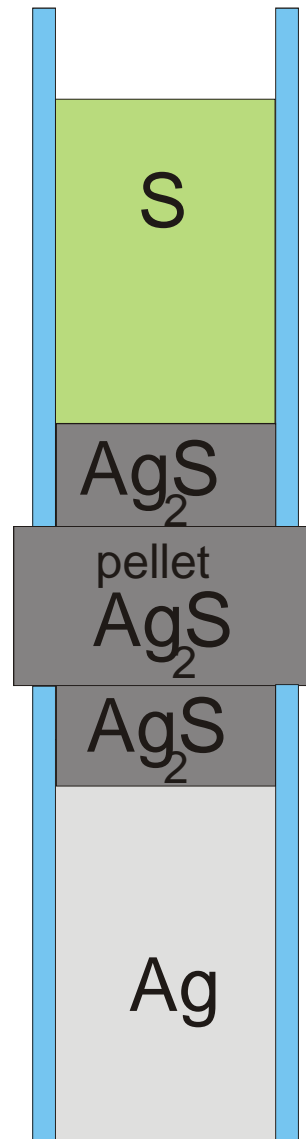
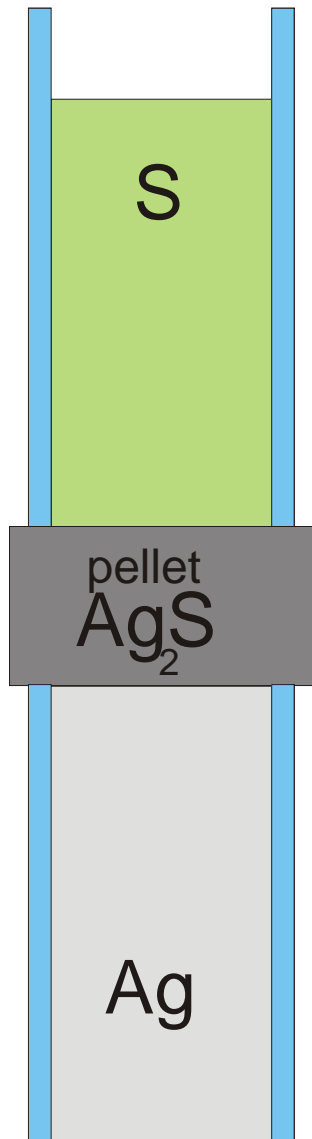
Formation of a triple-layer scale in the flat surface region



Influence of edges on the morphological build of scales



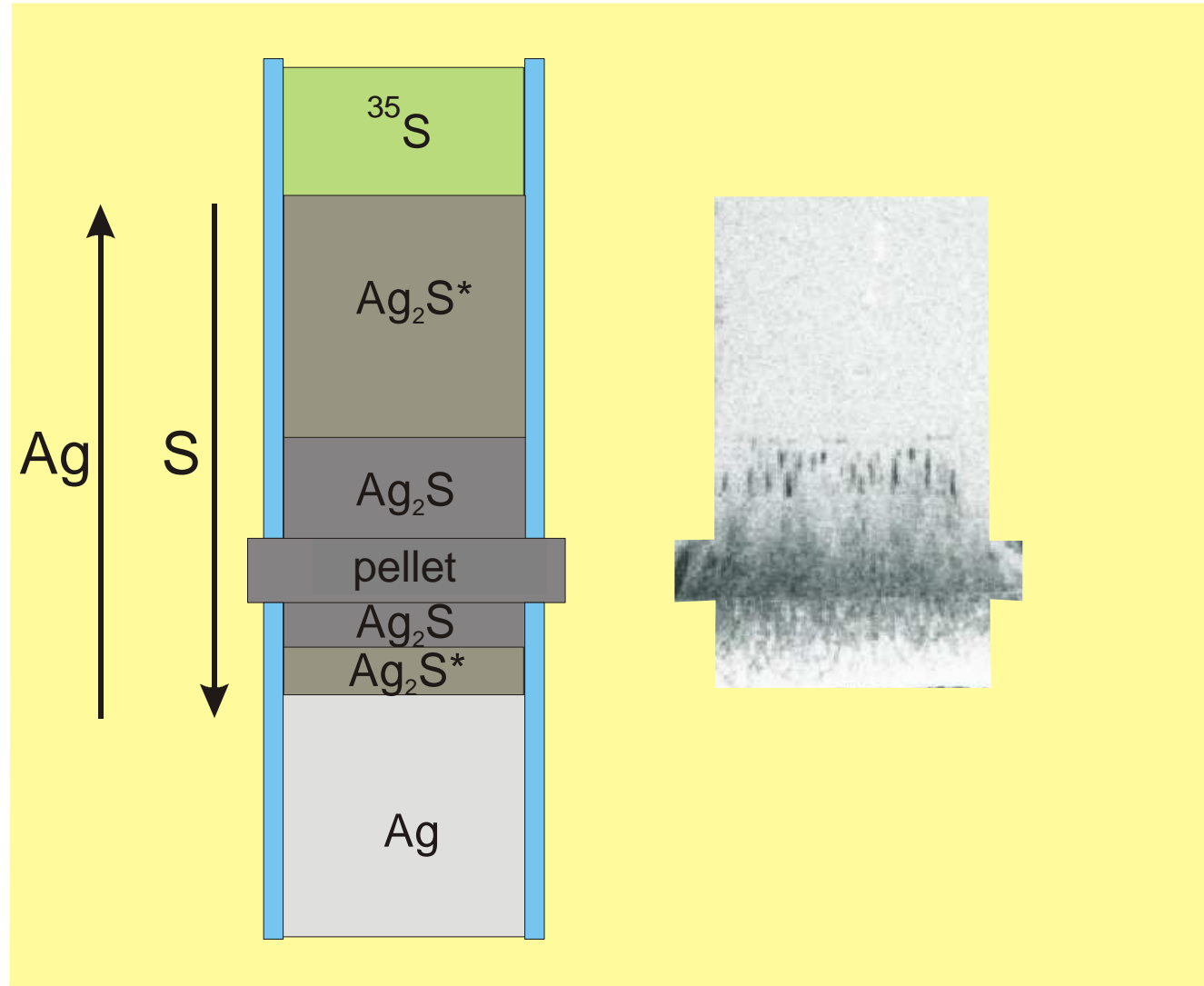
Two-stage sulphidation in the modified Wagner pellet method



Two-stage sulphidation in the modified Wagner pellet method



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S. Mrowec, „Dissociative Mechanism of Scales Growth on Metals and Alloys”, High Temperature Materials and Processes, **24**, 375 (2005).

Two-stage sulphidation in the Wagner pellet method



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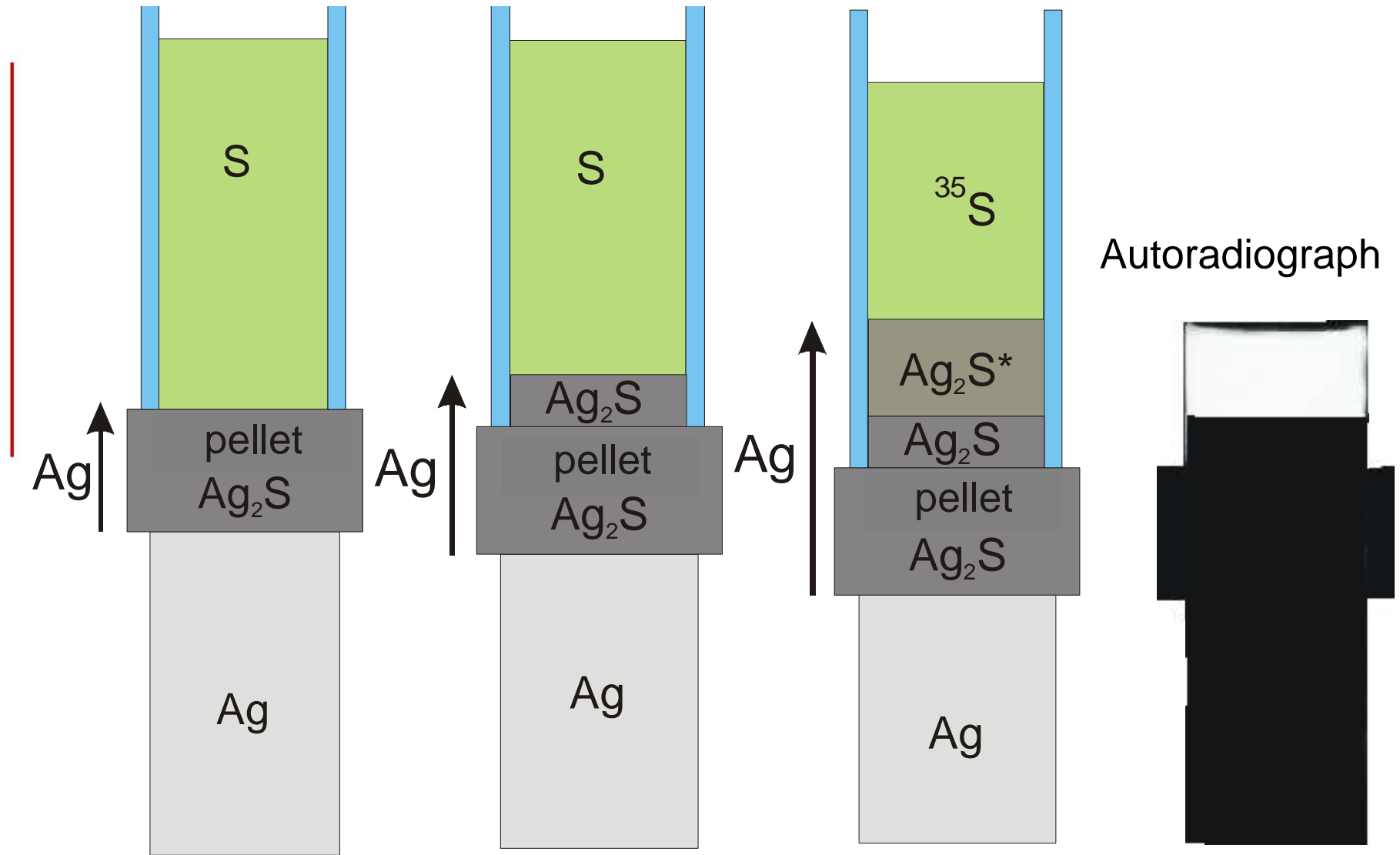
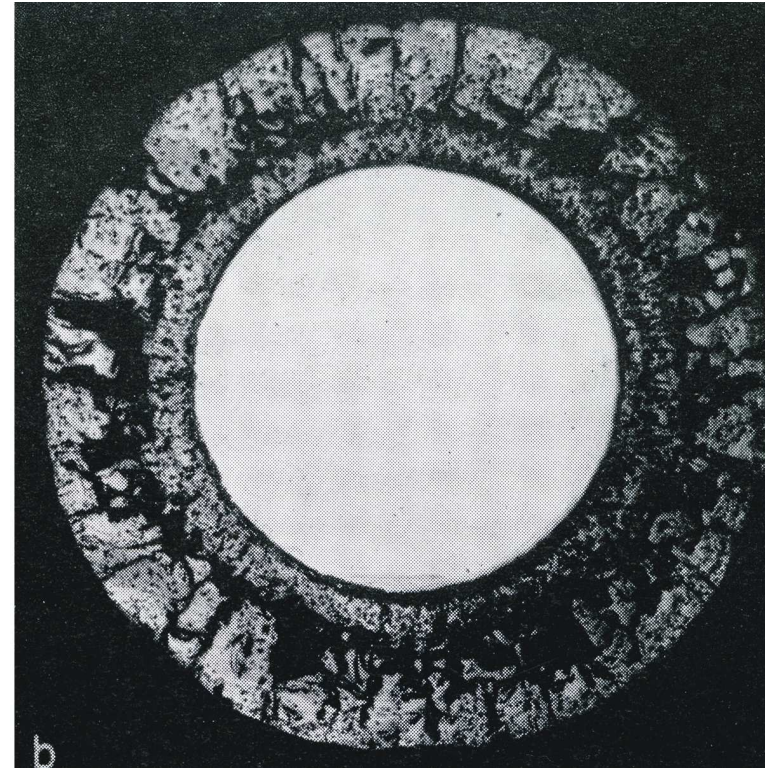
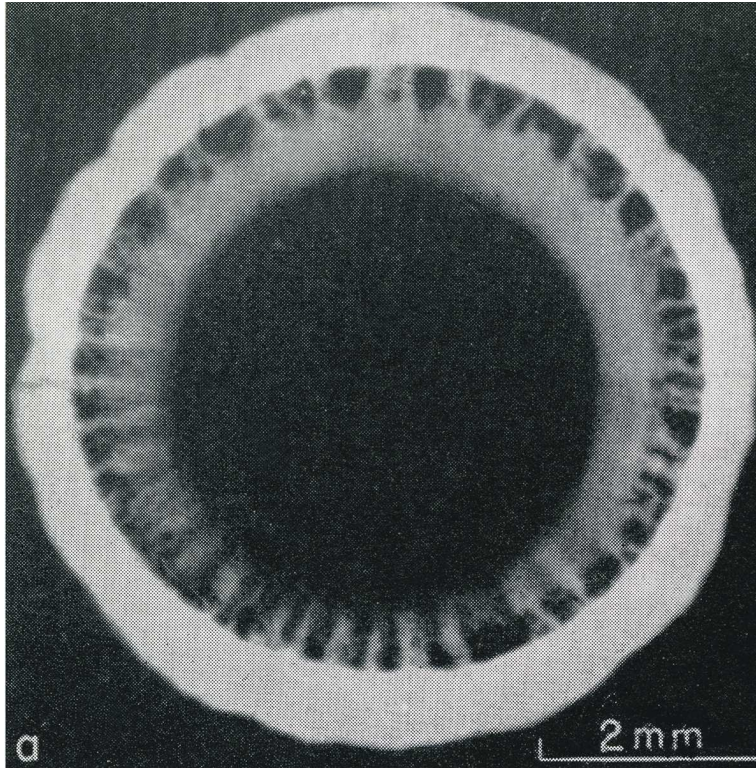
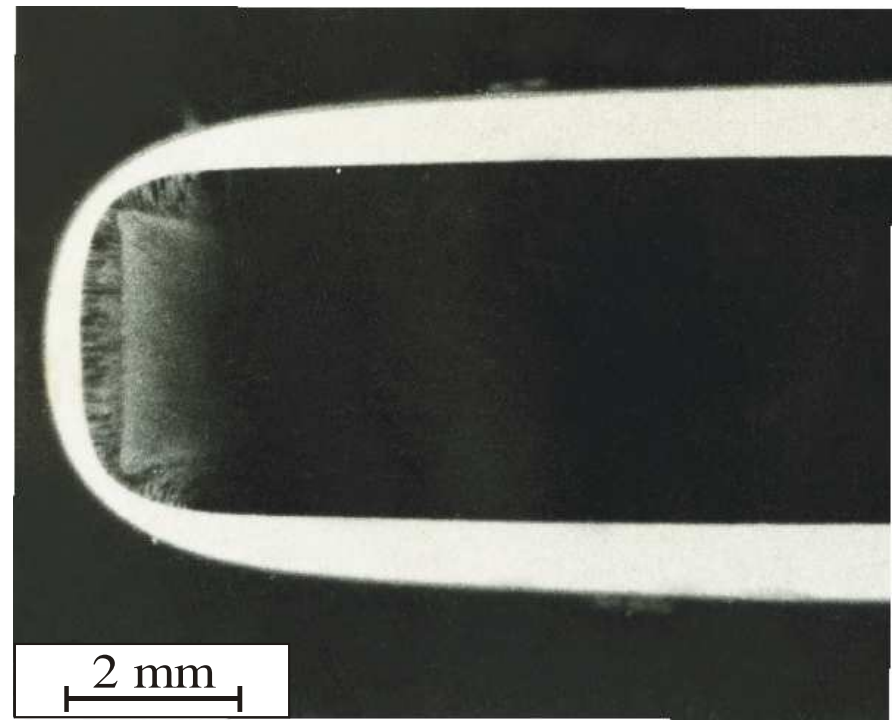
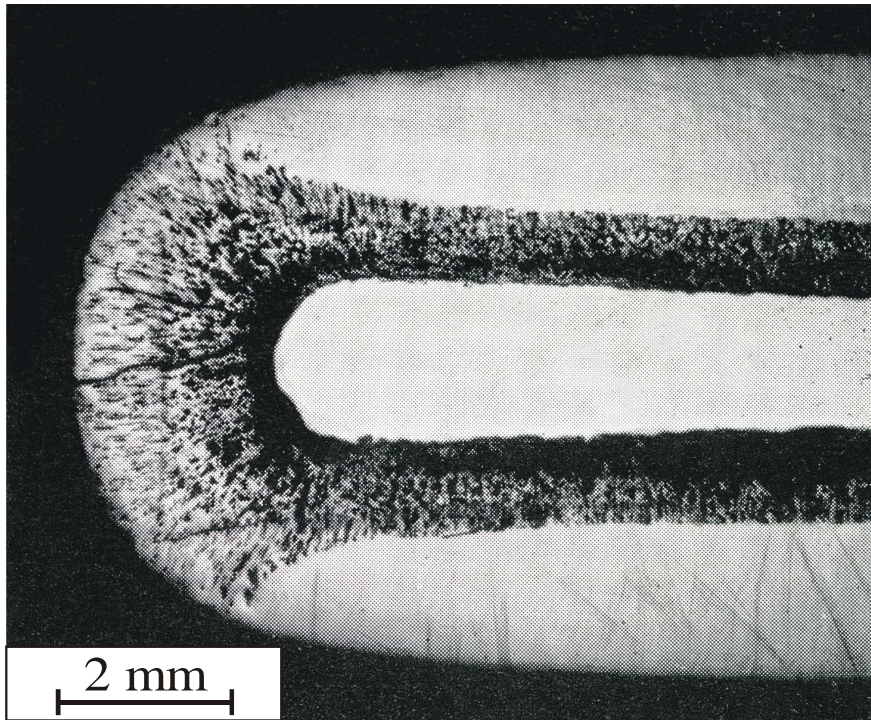


Illustration of dissociation fissures in a sulfide scale on iron



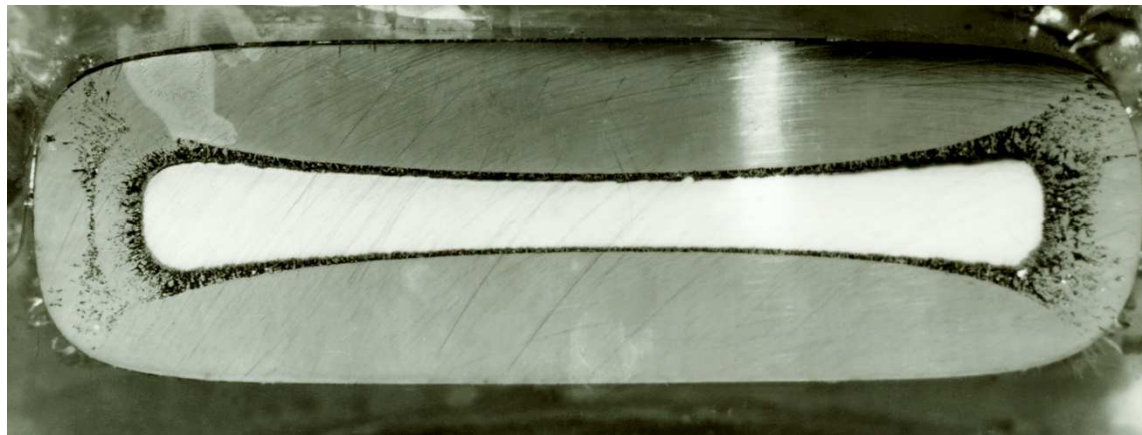
Autoradiogram

Influence of edges on the formation of a sulfide scale on copper

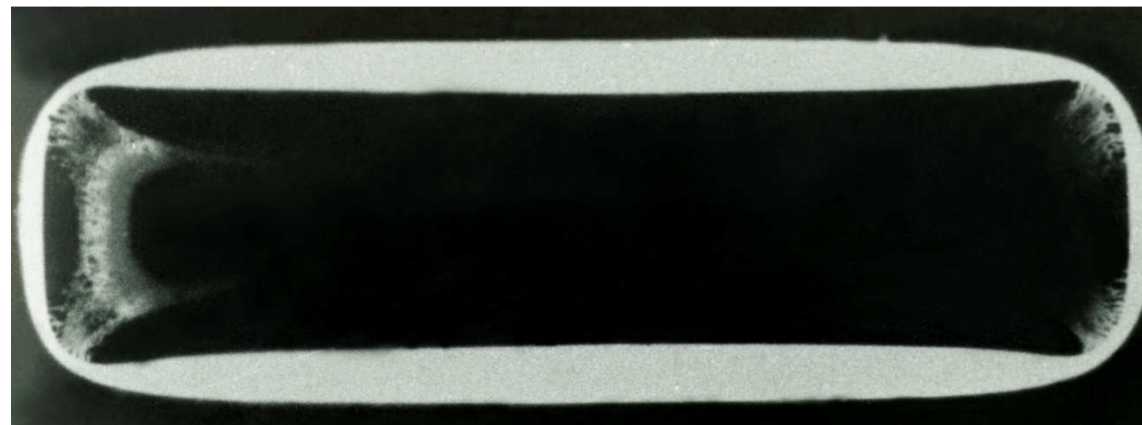


Autoradiograph

Influence of edges on the formation of a sulfide scale on silver

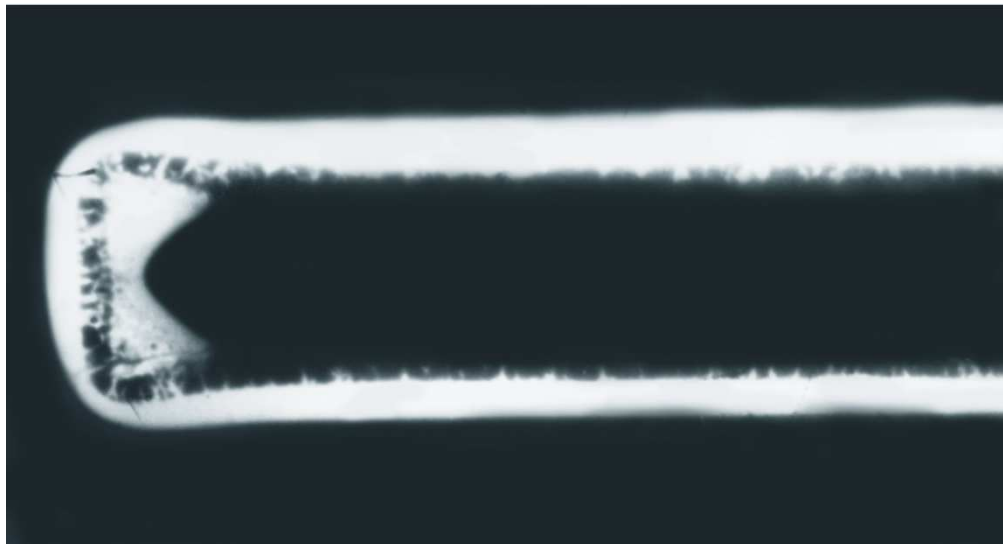
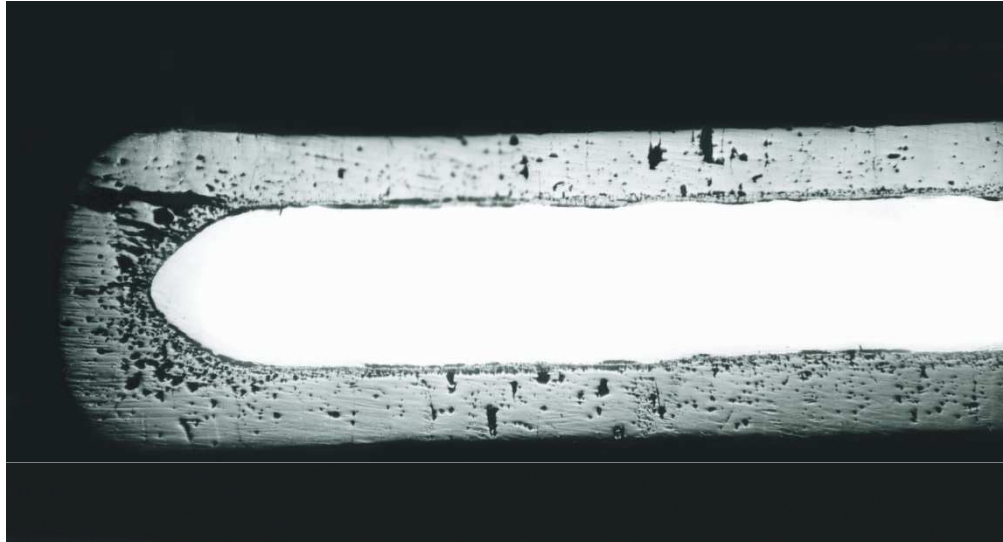


photograph



autoradiograph

Influence of edges on the formation of an oxide scale on cobalt



autoradiograph

Reaction leading to the formation of radioactive fluorine ^{18}F from oxygen ^{18}O by means of bombarding the scale cross-section using a proton beam

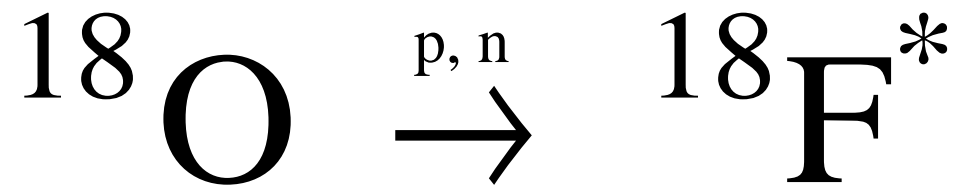
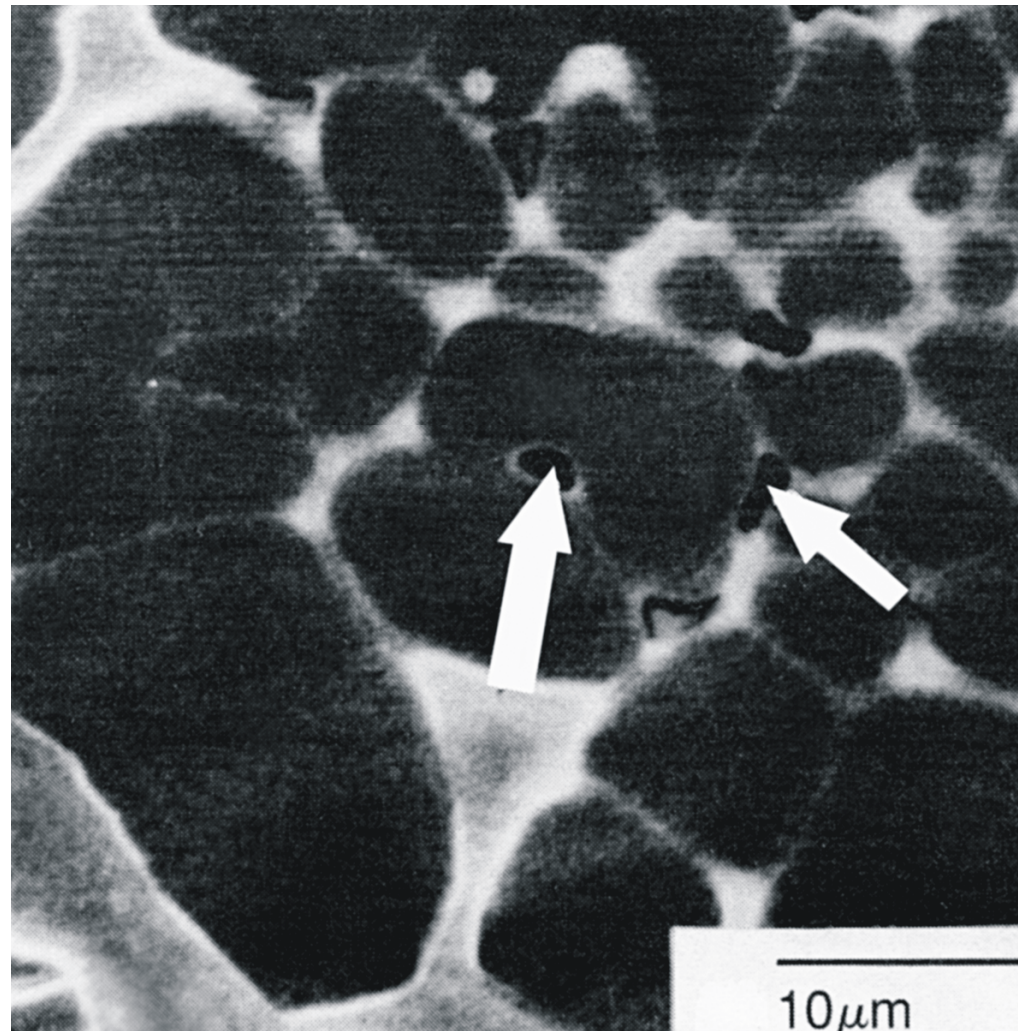


Image of dissociation fissures in an oxide scale growing on copper, obtained in an “*in situ*” experiment



Cross-section of a scale on A-B alloys that grows according to the dissociation mechanism

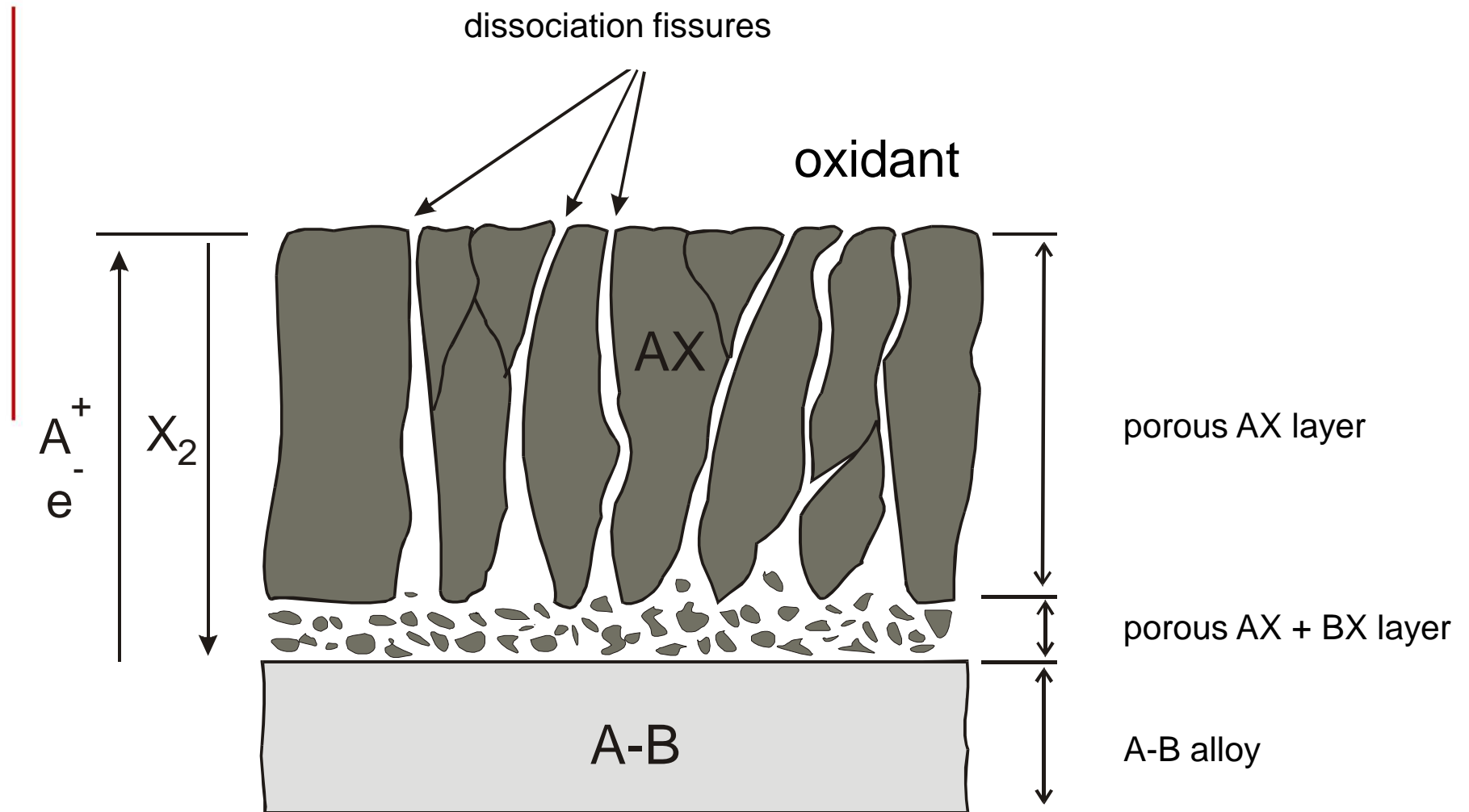


Image of a two-layer sulfide scale on Cu-9%Zn alloy, obtained in a two-stage sulphidation process

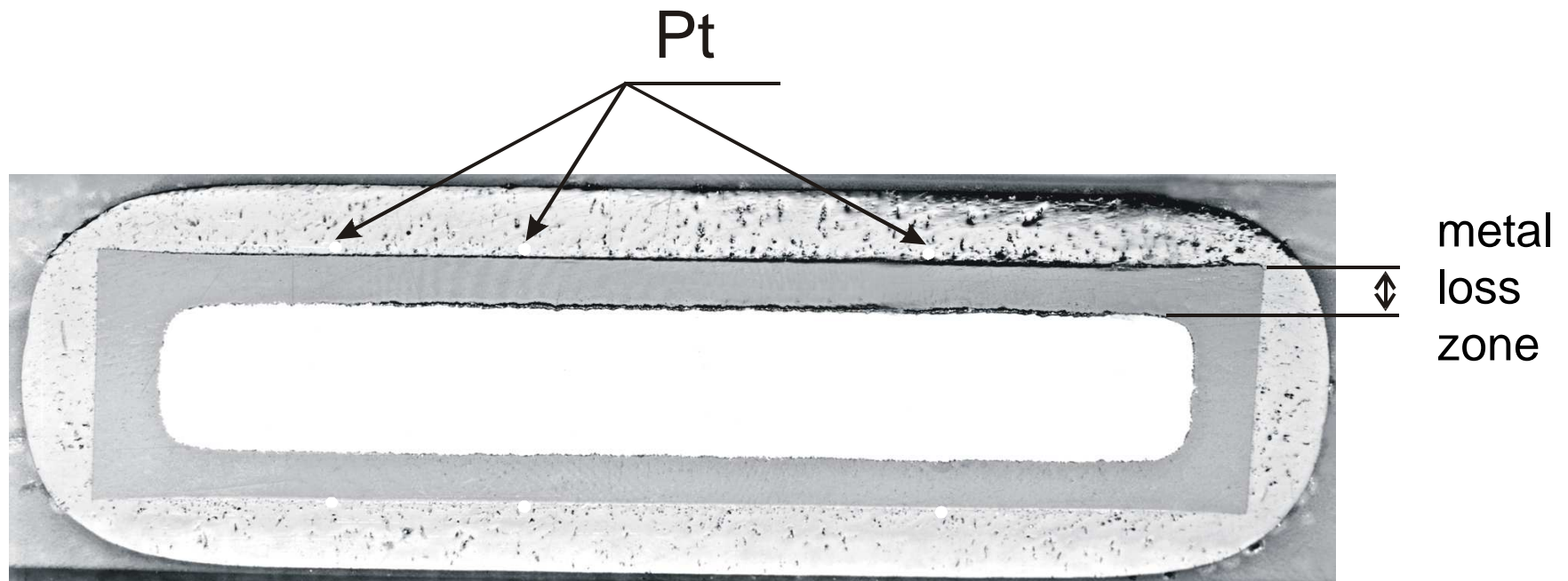


Image of a two-layer sulfide scale on Cu-9%Zn alloy, obtained in a two-stage sulphidation process

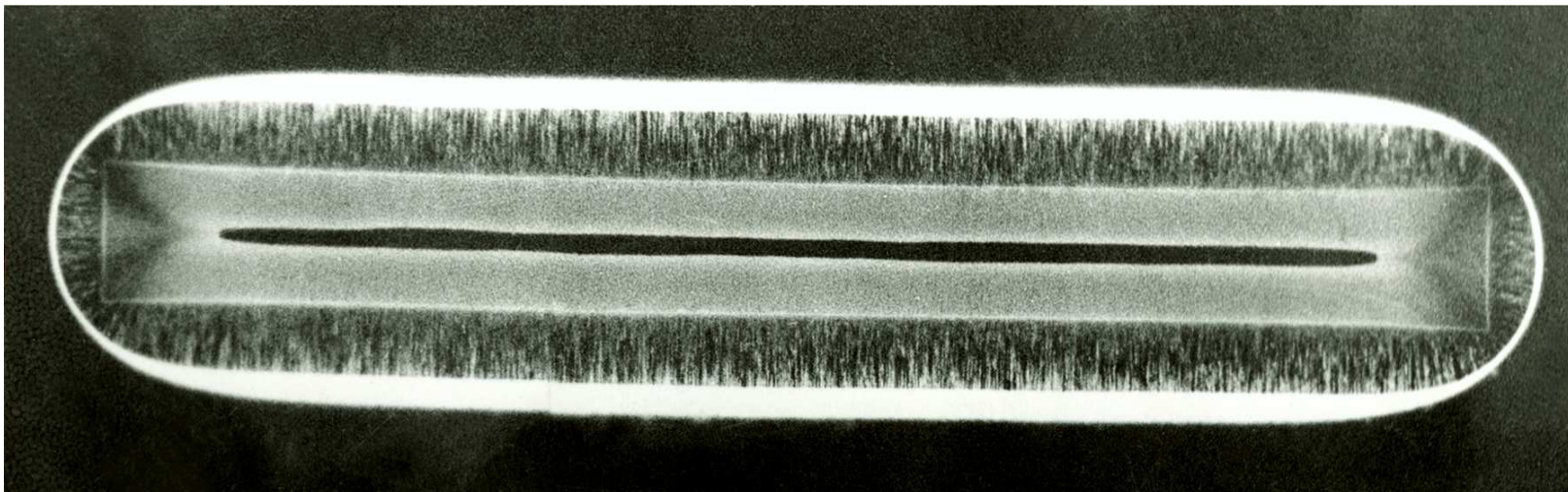
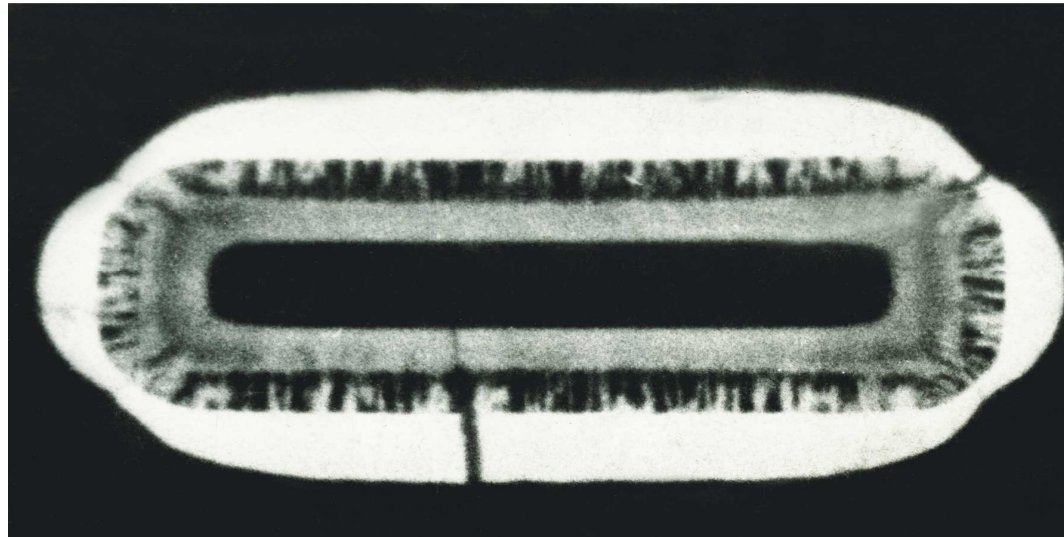
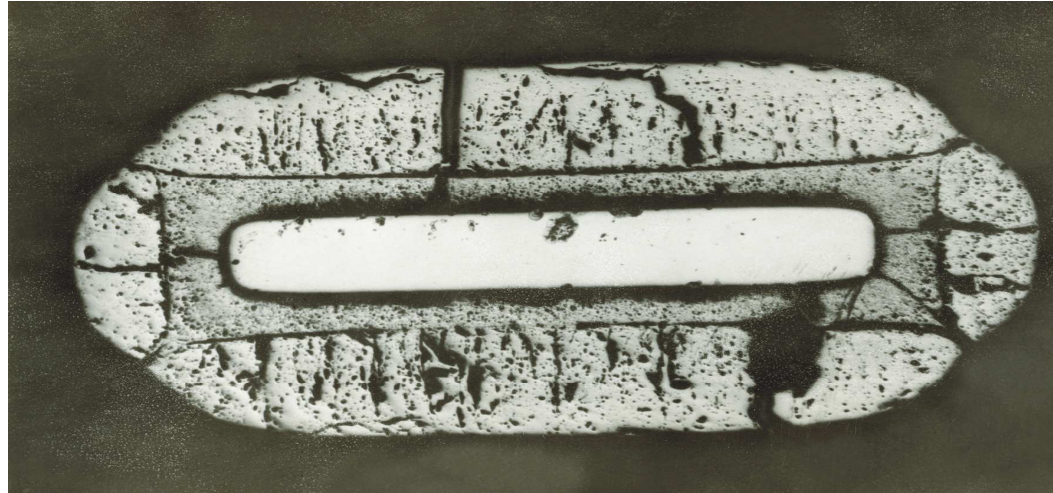
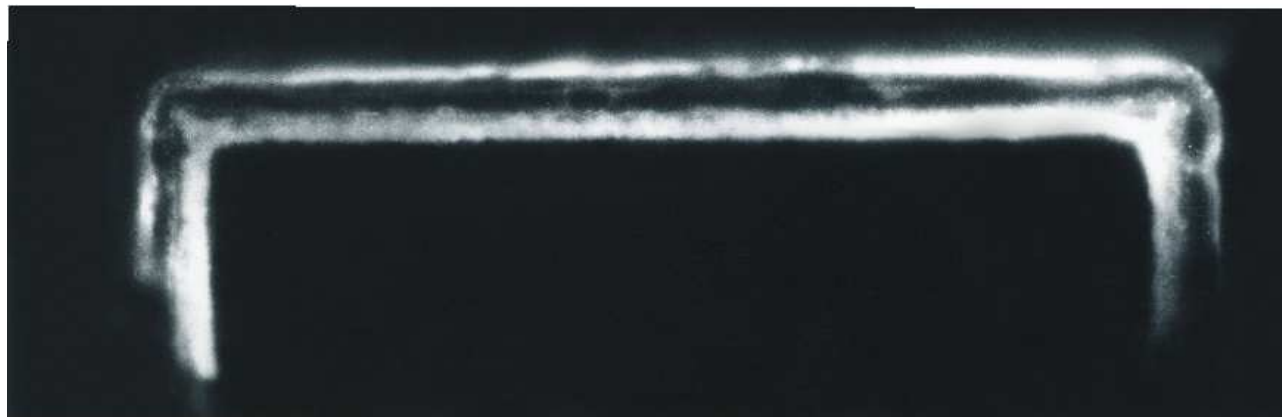
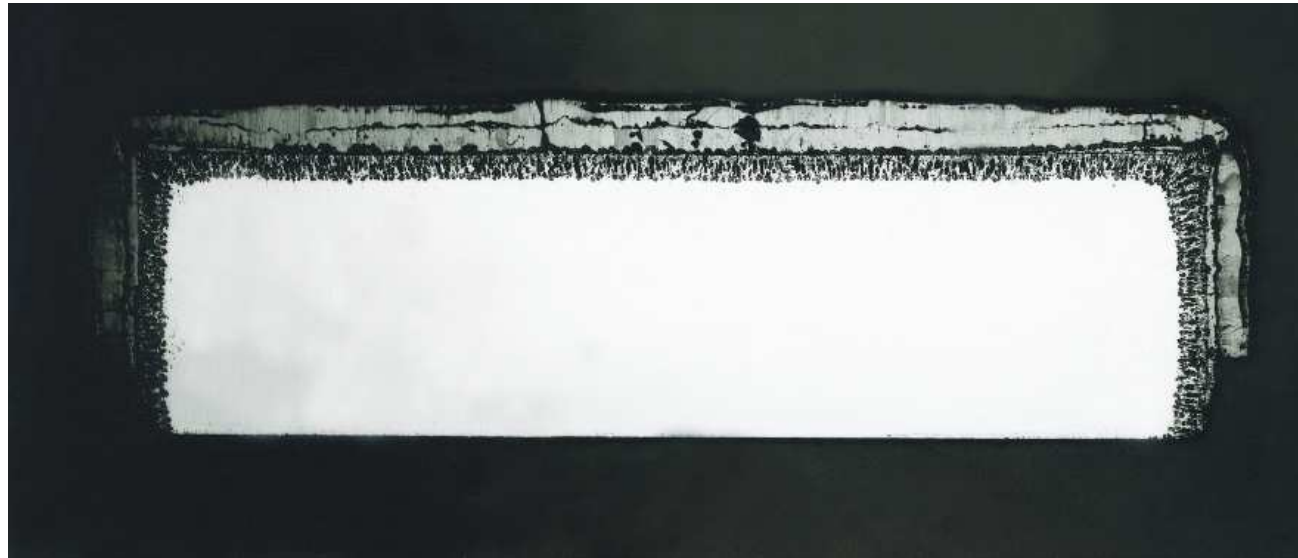


Image of dissociation fissures in a sulfide scale on an low-alloy steel, obtained in a two-stage sulphidation process



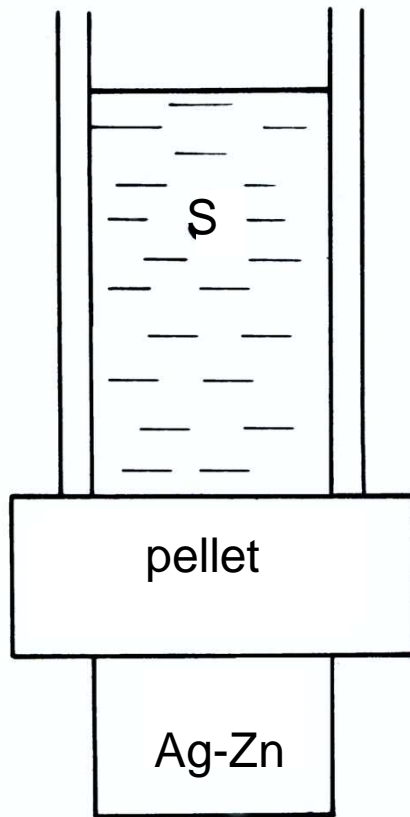
autoradiograph

Image of dissociation fissures in a sulfide scale on an low-alloy steel, obtained in a two-stage oxidation process

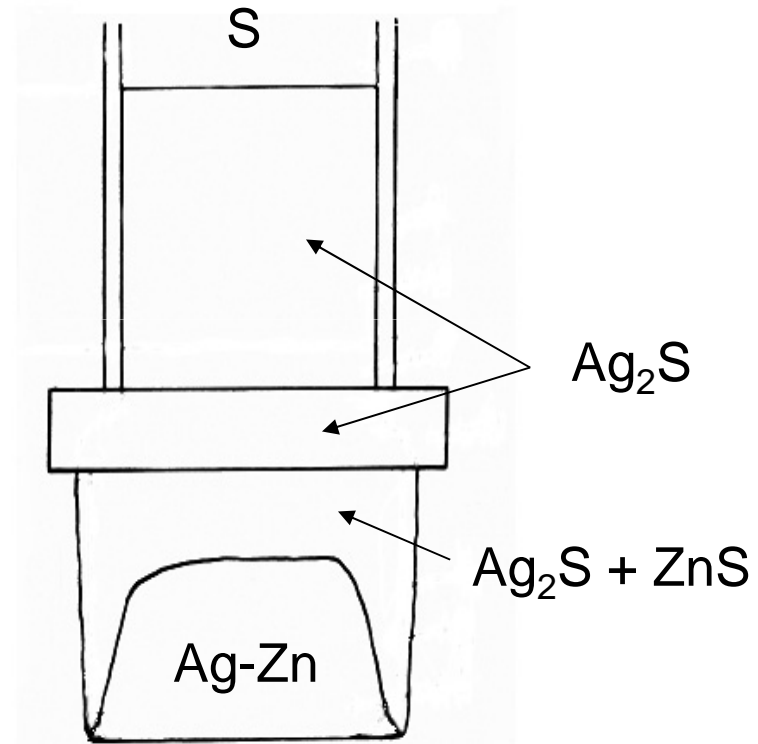


autoradiograph

Schematic illustration of Wagner's pellet method, used for sulphidation of an Ag-Zn alloy

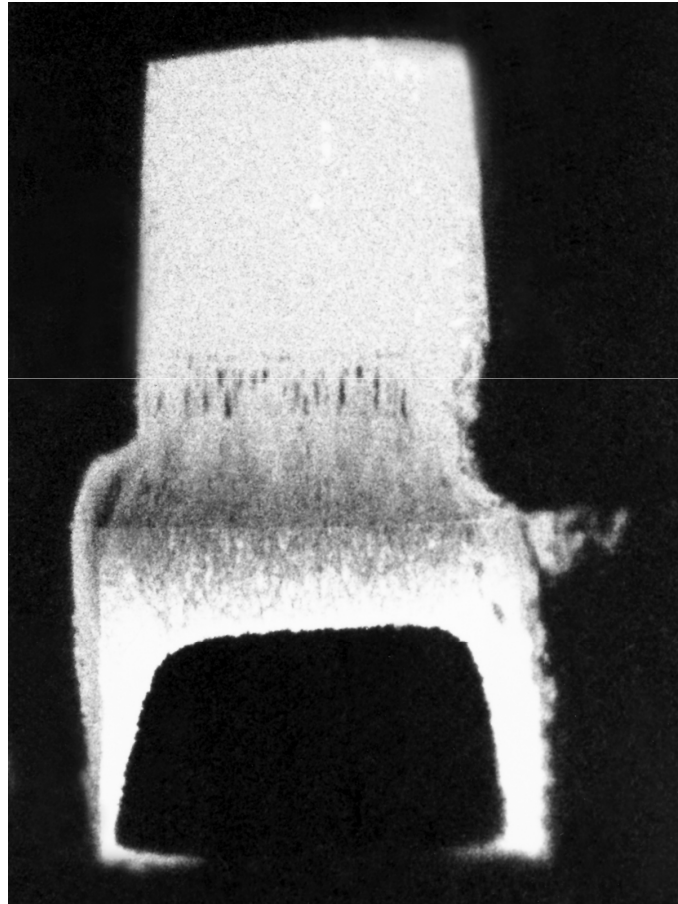


Before the reaction

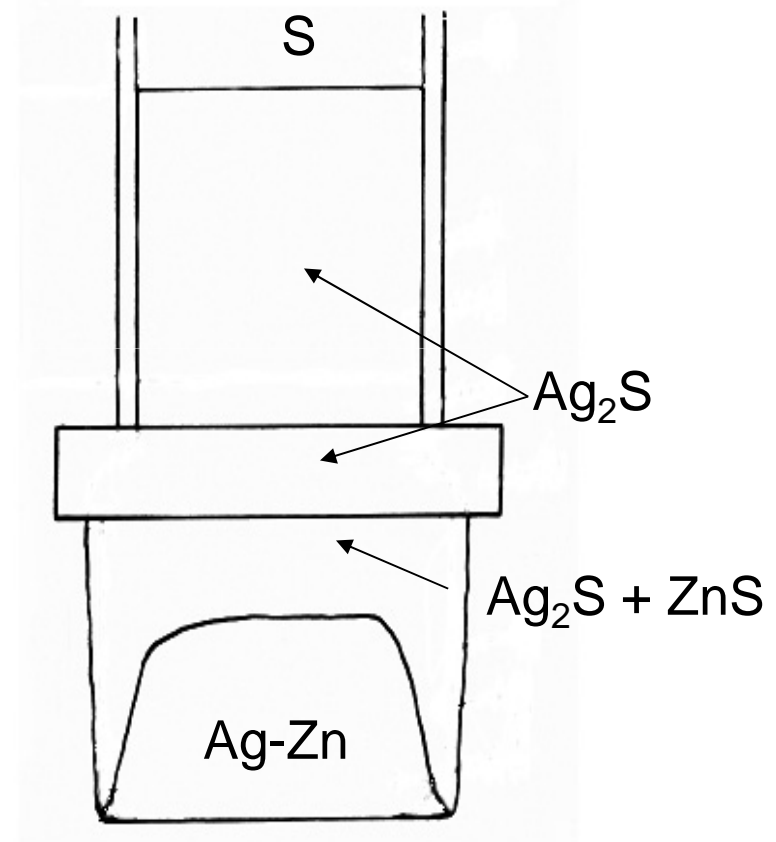


After the reaction

Ag-Zn alloy after a two-stage sulphidation experiment in a pellet system



autoradiograph



schematic illustration
of the system

SUMMARY

The results of the presented experiments have been recognized in literature as final proof that the specific, dependent on the geometry of the reactive system, morphology of scales growing on metals and alloys should be associated, first and foremost, with the anisotropic dissociation process of the initial compact layer, and not with scale cracking due to stresses.



THE END