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MEASUREMENT OF TRITIUM CONTENT WITH A NOVEL DETECTOR SYSTEM

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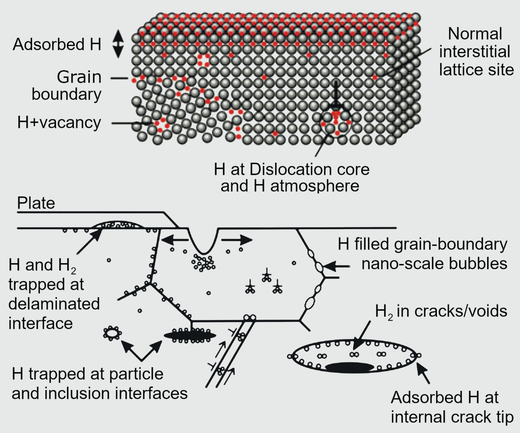
MOTIVATION

Quantification and *in situ* characterization of hydrogen embrittlement still challenging:

- Mechanisms are controversially debated
- Determining Hydrogen position and motion during deformation remains difficult

Existing methods:

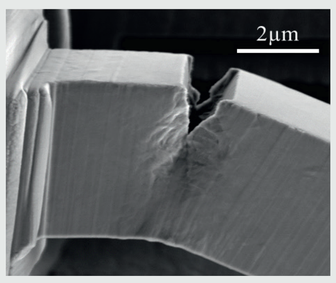
- Partly destructive
- *Ex situ*
- Fail to portray the strong variation of Hydrogen concentration across the microstructure



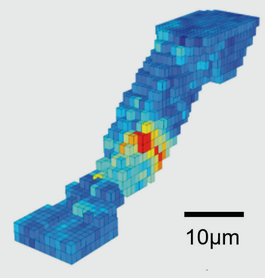
Modified from S. Lynch, (2012), Corrosion Reviews 30, 3-4, 2012,105-123

TRITIME**-Approach **(TRITIum based micro MEchanics)

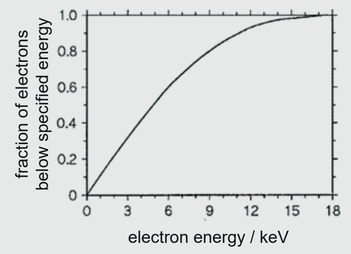
- *In situ* micromechanics
- SEM
- µLaue
- $^3H \leftrightarrow H$



A.S. Kumar, C. Kirchlechner, unpublished



- Rare isotope
- Changes in diffusion behaviour



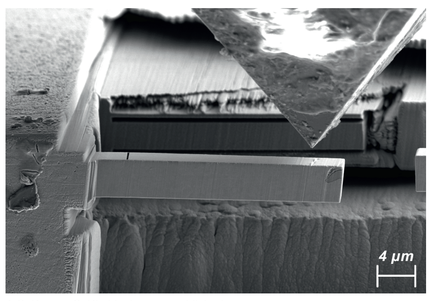
A.M. Kellerer et al., (1993), Radiat Environ Biophys, 32:183-191

ISOLATE → OBSERVE → QUANTIFY

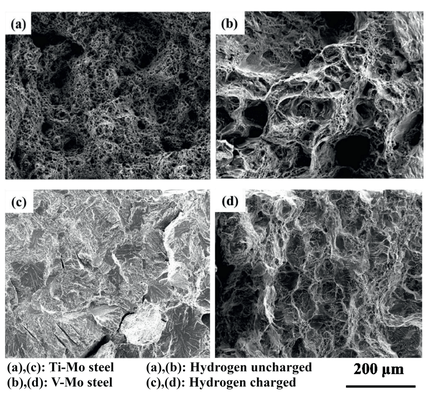
Can we measure the local tritium concentration for *in situ* small scale mechanical testing?

METHODS

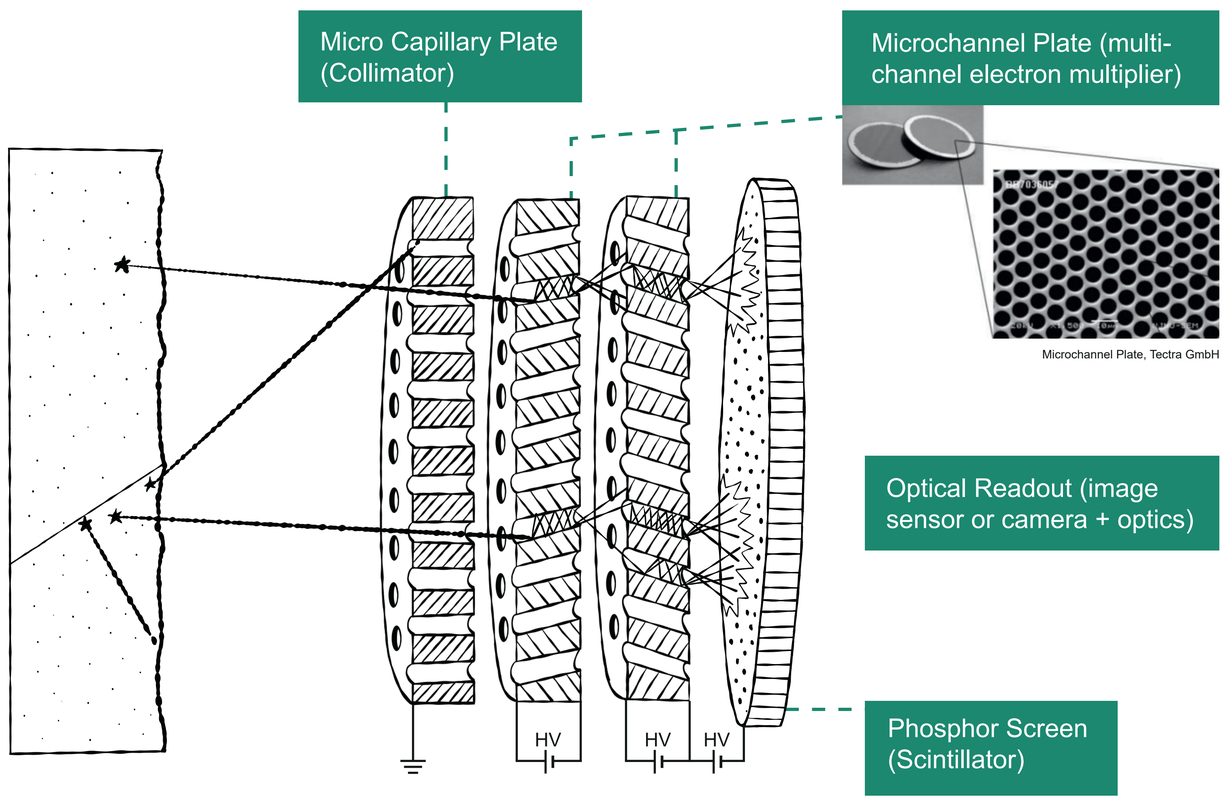
What are we trying to capture?



A.S. Kumar, C. Kirchlechner, unpublished



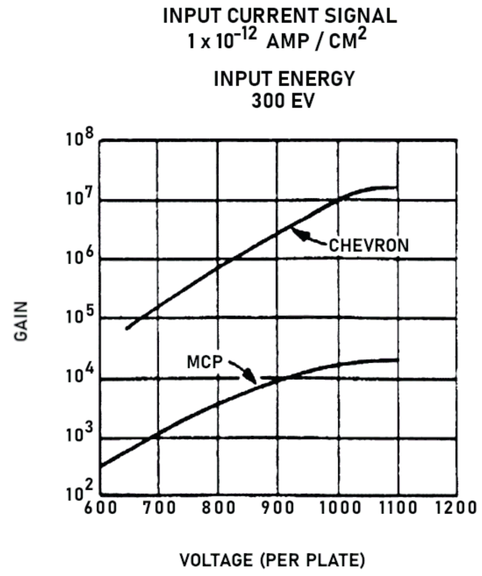
Modified from P. Gong et al., (2022), Acta Materialia 223



Microchannel Plate, Tectra GmbH

Specifications

- Spatial resolution: Goal: < 10 µm
- Gain:

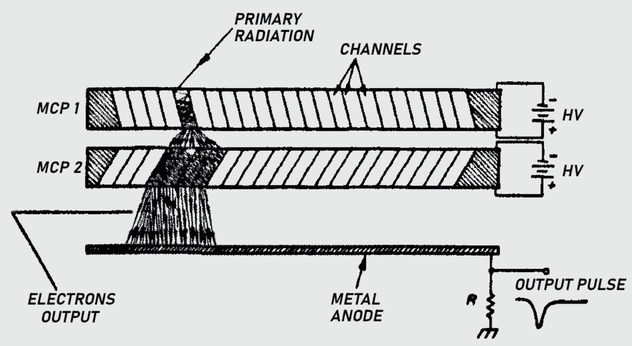


Modified from J. L. Wiza, (1979), NIM 162, 1–3, 587-601

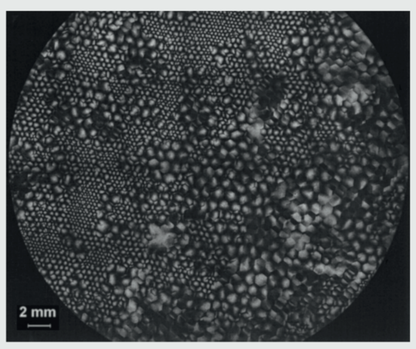
Our goal is to develop a microchannel plate based detector system capable of remote observation and mapping of the position and concentration of tritium in microstructures

CHALLENGES

- Low activity & incident rate → We need to get close!
- Limited achievable spatial resolution
- Imaging errors

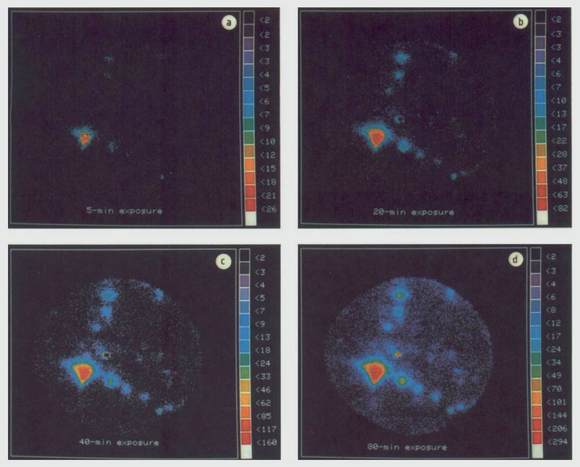


Modified from J. L. Wiza, (1979), NIM 162, 1–3, 587-601



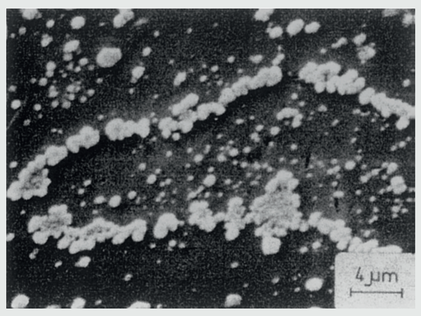
A. S. Tremsin et al., (1999), Appl. Opt. 38, 2240-2248.

EXPECTED OUTCOME & OUTLOOK



S. Burbeck et al., (1983), Electrophoresis, 4: 127-133.

- Verification and cross-reference experiments
  - ^3H-Radiography
  - Hydrogen Micro Print (HMT)



J. Ovejero-García, (1985), J Mater Sci 20, 2623–2629

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