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Influence of tin addition to Al-3%Mg (wt.%) alloys for hydrogen generation

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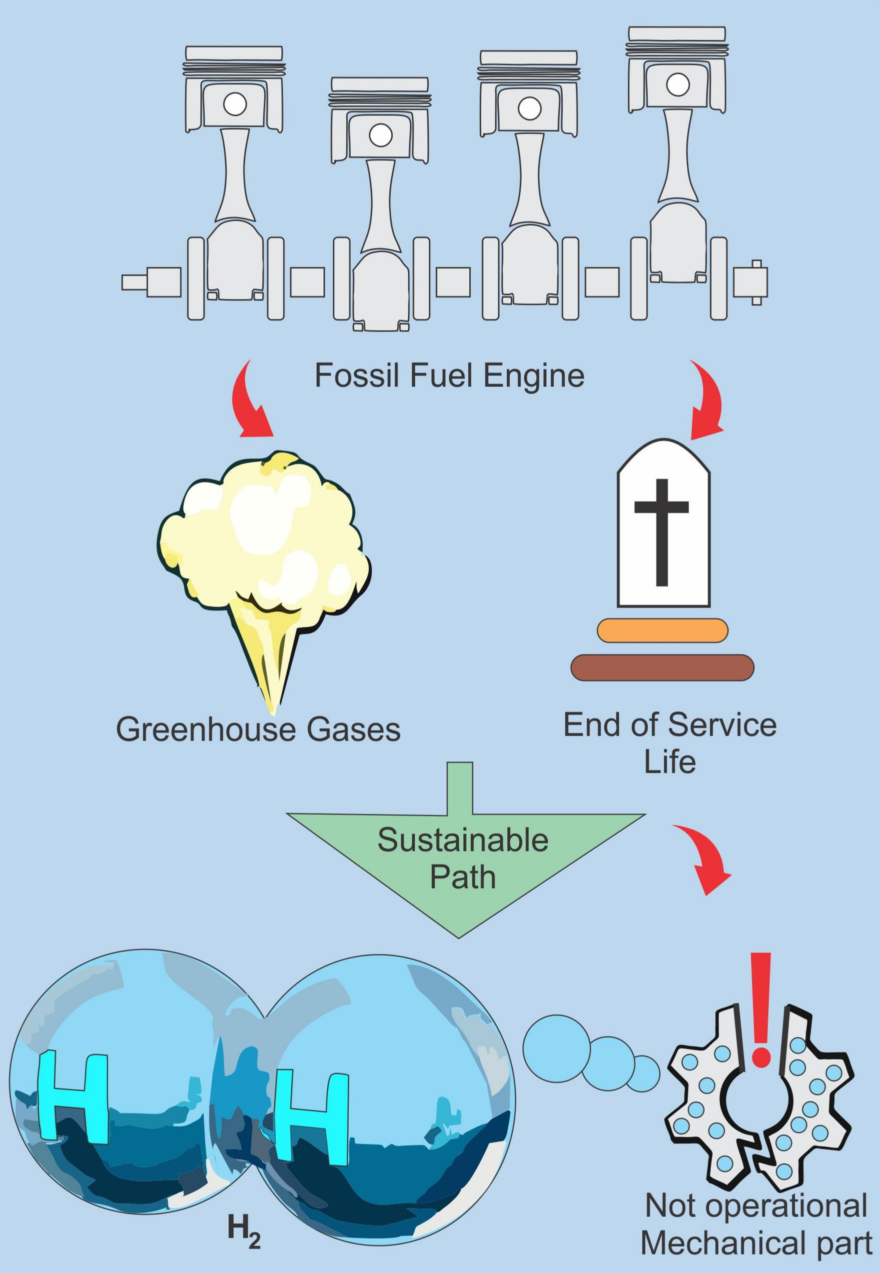
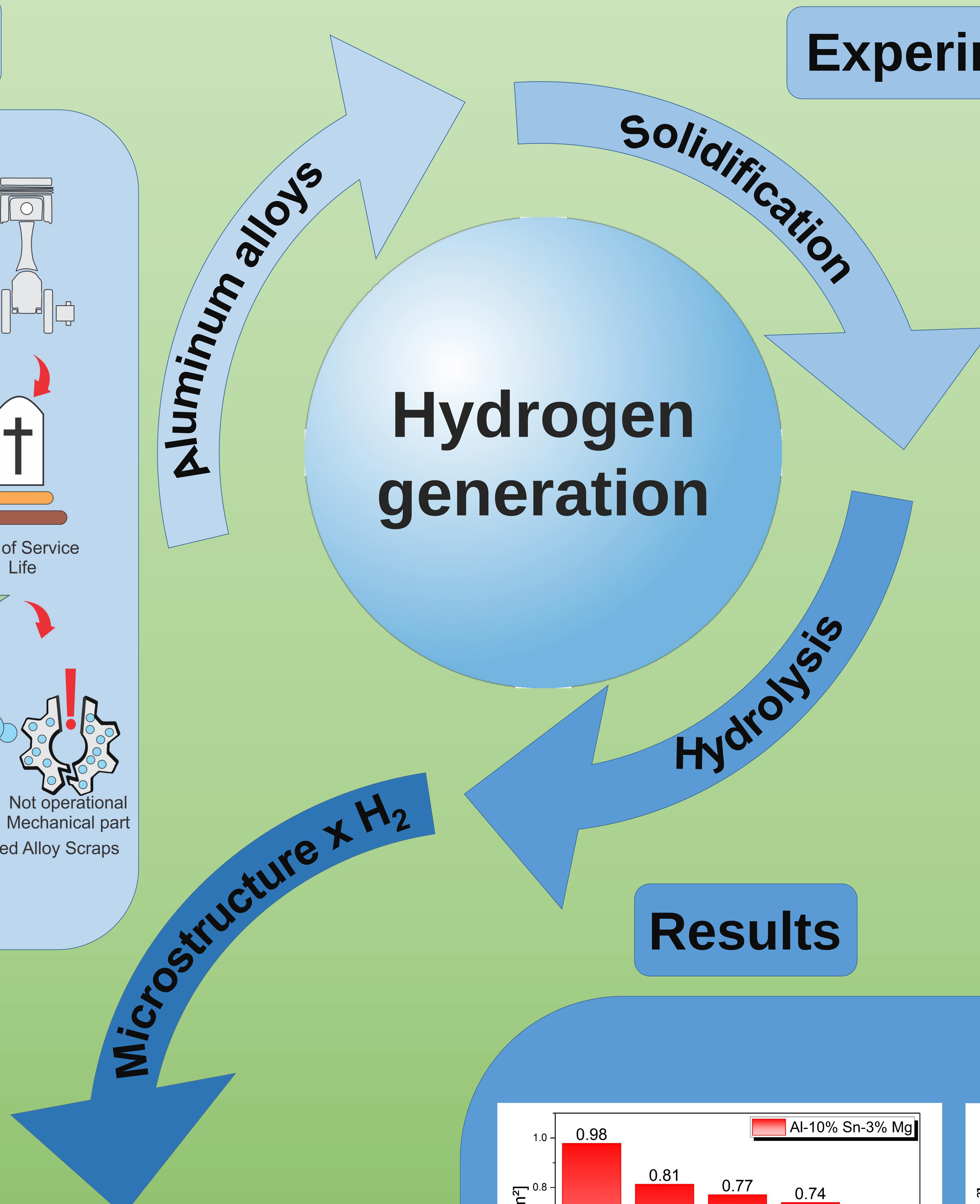
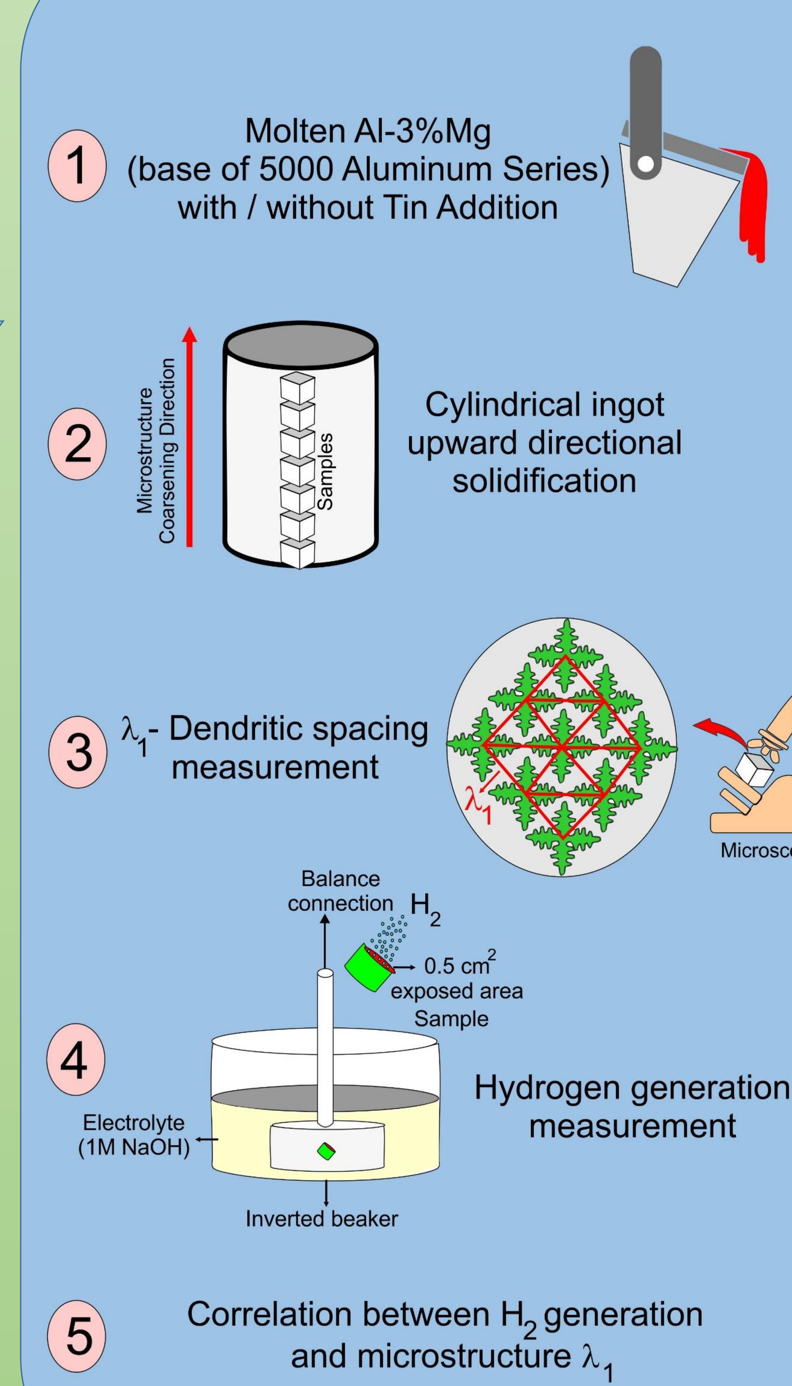
Introduction



Hydrogen Generation from Aluminum-based Alloy Scraps
Clean Energy

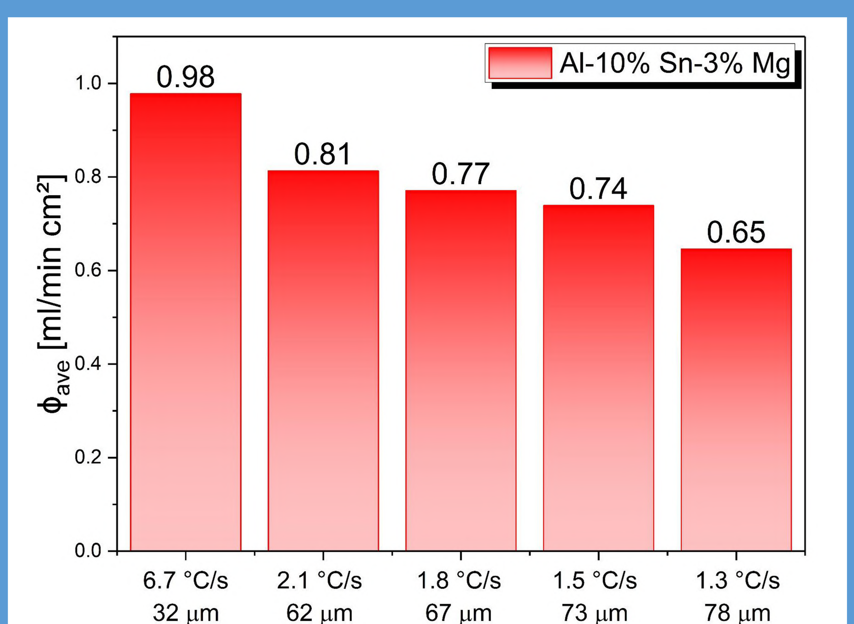


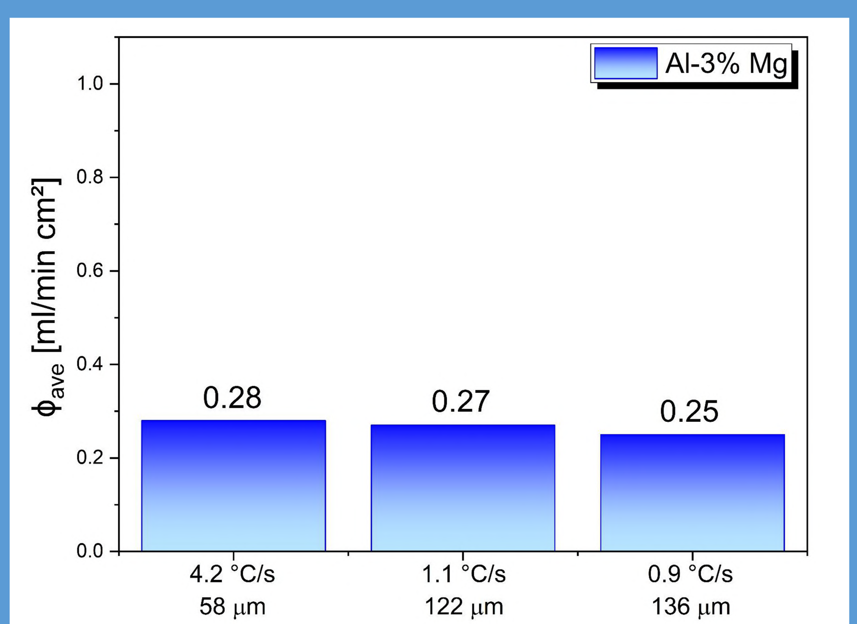
Experimental procedure



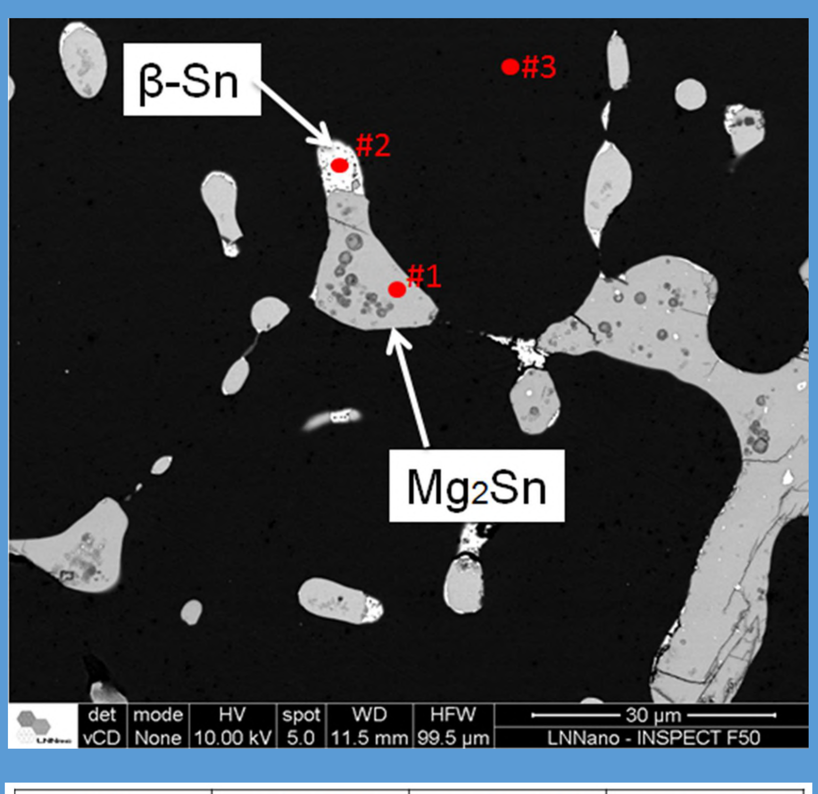
Keywords:
- Solidification;
- Hydrogen generation;
- Microstructure;
- Hydrolysis.

Results





Hydrogen flow rate for different microstructure length scales (λ_1 - µm) of Al-10%Sn-3%Mg and Al-3%Mg alloys and cooling rates (°C/s) during solidification.

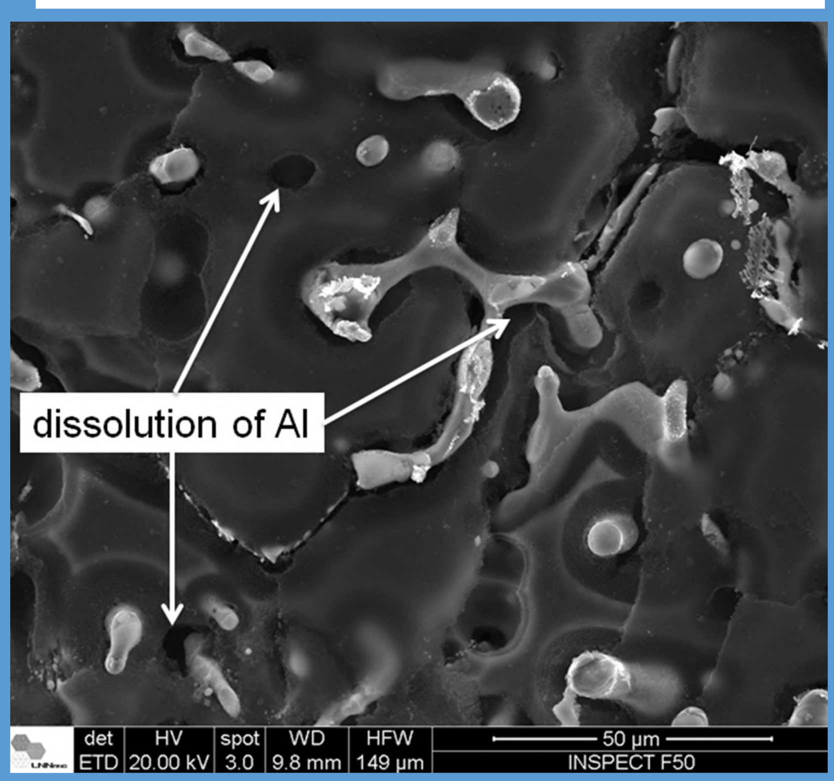


Point	Al (wt.%)	Mg (wt.%)	Sn (wt.%)
#1	0.39	28.11	71.50
#2	0.64	0.02	99.34
#3	98.95	0.97	0.07

Elemental SEM-EDS analyses in a transverse section of the Al-10%Sn-3%Mg alloy casting.

β–Sn and Mg_2Sn: Cathodes
Al: Anode

$$Al + 3H_2O + NaOH \rightarrow NaAl(OH)_4 + \frac{3}{2}H_2$$



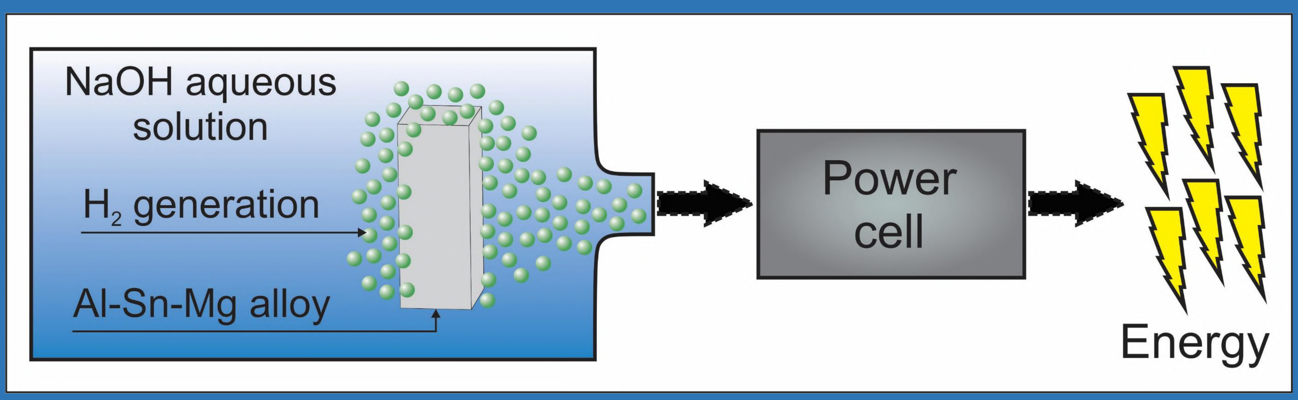
SEM image showing the microstructural changes in the Al-10%Sn-3%Mg alloy after 40 minutes of hydrogen evolution tests.

Conclusions

- Hydrogen Generation Rate for Al-3%Mg Alloy:
Low sensitivity to microstructural variation, averaging about 0.26 ml/cm²·min.

- Impact of Microstructural Refinement on Al-3%Mg-10%Sn Alloy:
Variations in the cooling regime during solidification led to a 350% increase in hydrogen production (0.98 ml/cm²·min) compared to the Al-3%Mg alloy.

- Potential of Aluminum-based Alloy Scraps for Clean Energy



Acknowledgements

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