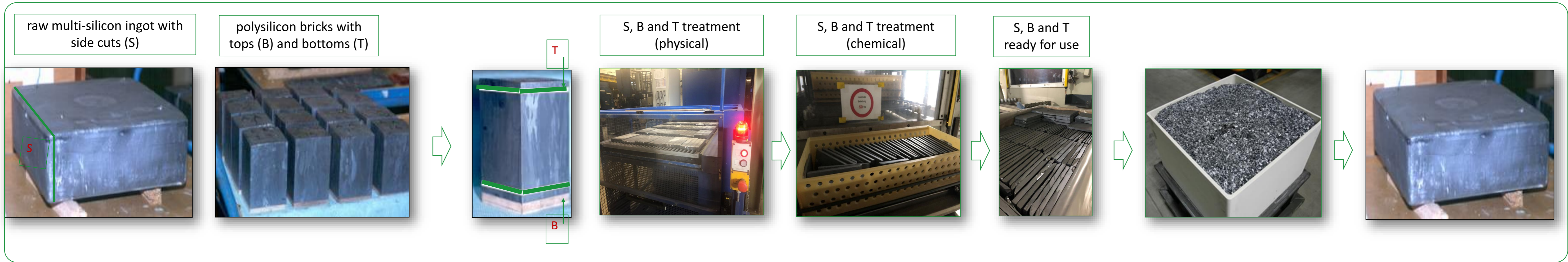


# ABOUT THE RECYCLING OF VARIOUS SILICON WASTE FROM PHOTOVOLTAICS

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Photovoltaic waste - there are not just modules! The reuse of side cuts, tops and bottoms after cleaning saves resources !



Manufacturing monocrystalline wafers also generates interesting waste -> reuse it and save resources!

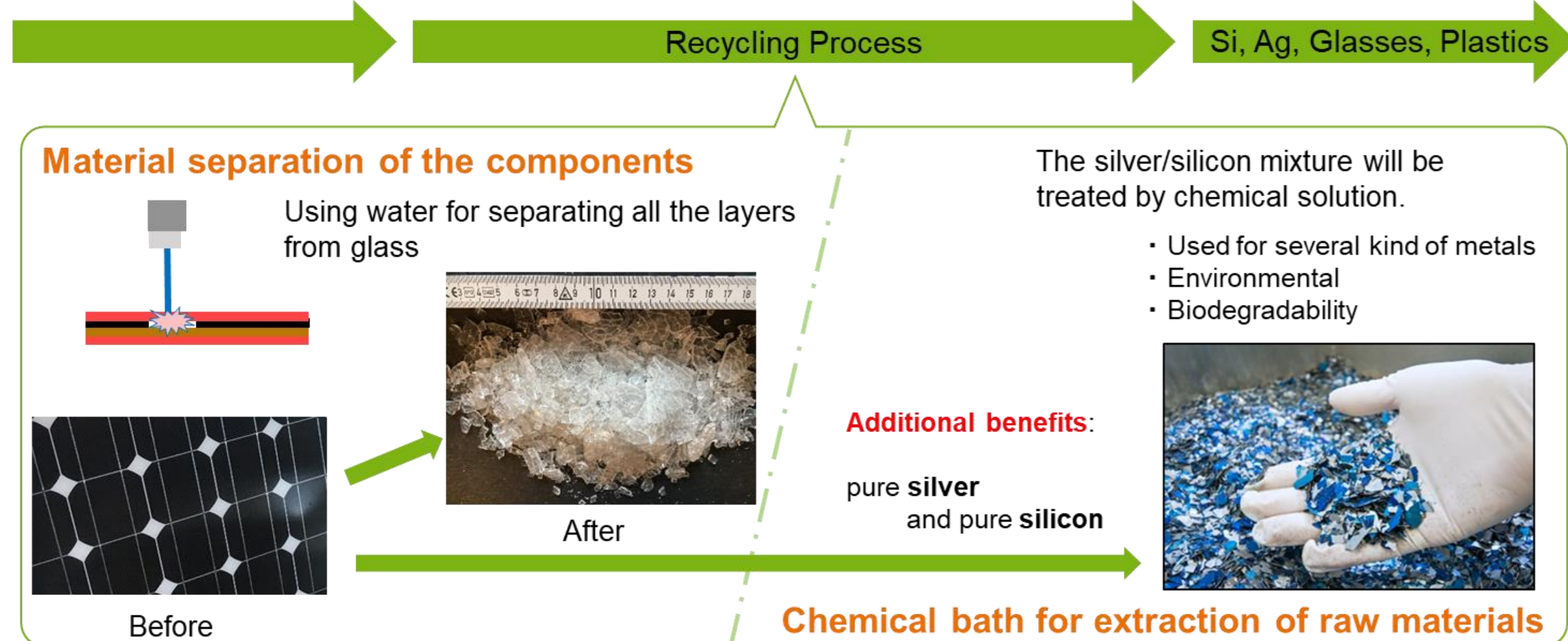


Photovoltaic waste – single glass c-Si modules can be separated. The reuse of materials after cleaning saves resources !



The de-metallized silicon grains are further purified in a fine grain etching plant and can finally be processed directly to ingots with other material (see also work described on poster DDV.4.10). Thus, the recovered silicon is also available for other applications, such as target production for PVD applications or powders for thermal spraying applications.

We obtained a very high level quality of glass, usable demonstrably for float glass production, see analytical data for one example:



Mass %	0,13	0,013	8,08	4,57	0,004	13,60	0,02	0,001	0,004	0,0005	0
ICP-OES DIN 51086-2	Al <sub>2</sub> O <sub>3</sub>	Fe <sub>2</sub> O <sub>3</sub>	CaO	MgO	SrO	Na <sub>2</sub> O	K <sub>2</sub> O	Li <sub>2</sub> O	BaO	PbO	As <sub>2</sub> O <sub>3</sub>
Mass %	0	0,049	0,02	0,0004	0,001	0	0,0001	0	0	0,01	0,224
ICP-OES DIN 51086-2	CdO	Sb <sub>2</sub> O <sub>3</sub>	TiO <sub>2</sub>	Cr <sub>2</sub> O <sub>3</sub>	MnO <sub>2</sub>	Co <sub>3</sub> O <sub>4</sub>	NiO	CuO	SnO <sub>2</sub>	ZrO <sub>2</sub>	SO <sub>3</sub>

Rest: 73,28 mass.% SiO<sub>2</sub>

## ICARUS - PROCESSING AND REFINING OF SECONDARY RAW MATERIALS FROM SILICON PHOTOVOLTAIC MANUFACTURING



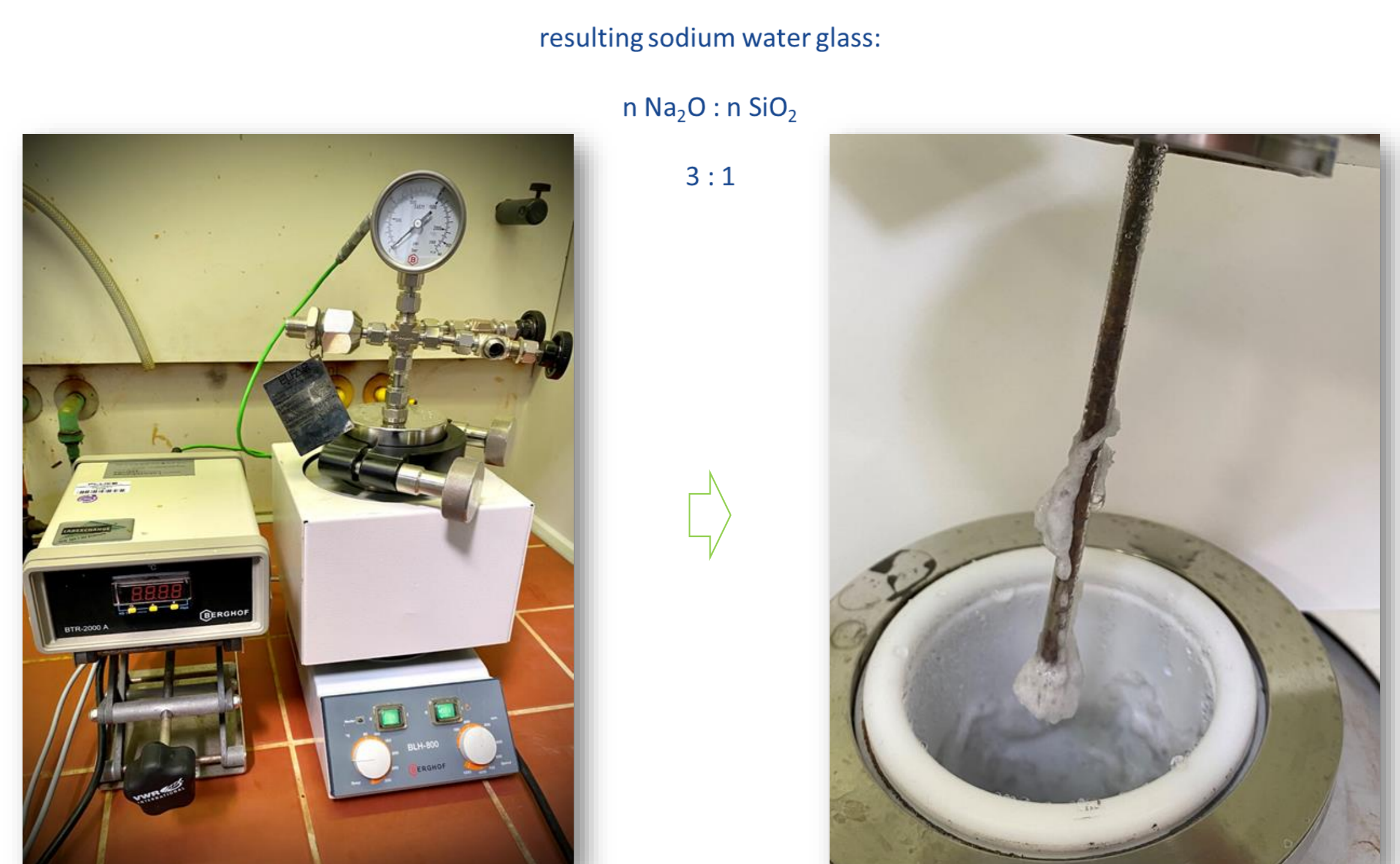
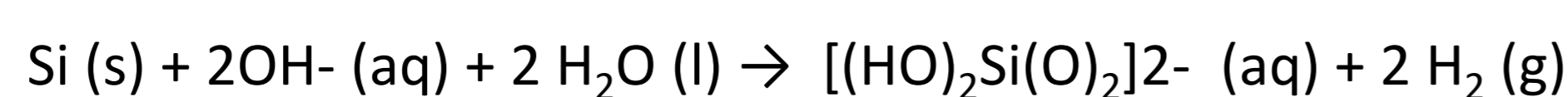
ICARUS



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ICARUS aims to demonstrate modular processing solutions at industrial scale to retrieve 95% of high-value raw materials from silicon ingot and wafer manufacturing. Powder, dust or sludge are produced in many processes when processing silicon. In the ICARUS project, we try, among other things, to use these fines and the energy stored in them in a meaningful way. One idea is the production of hydrogen. A simplified chemical equation which describes the overall silicon dissolution reaction can be written as follows:



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