

Recycling of silicon from photovoltaic production sludge

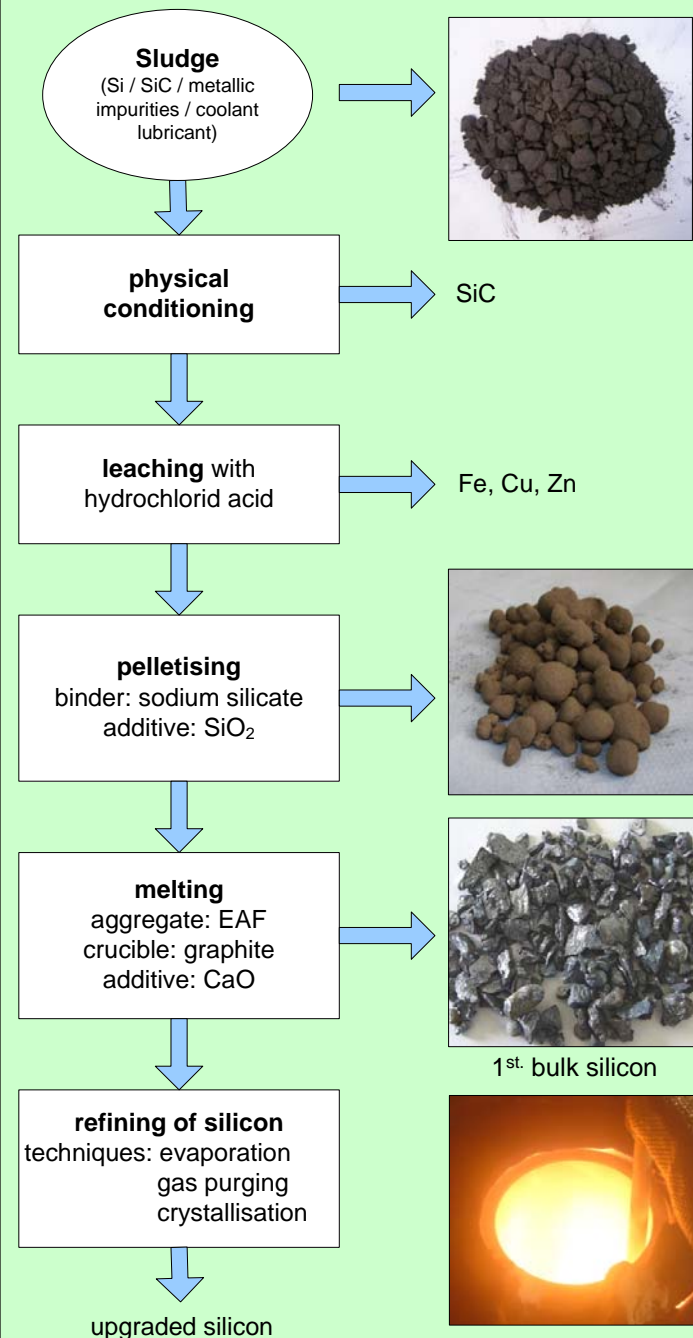
Motivation:

- global warming and CO₂-emission lead to a stronger usage of alternative energies like the photovoltaic
- over 90 % of present solar cells are manufactured on the basis of crystalline silicon
- SoG-Si production capacities are limited and prices high up to 200 US\$ / kg (spot market)
- the wafer cutting process generates approx. 34 % of Si losses in form of fine Si-powders in a sludge

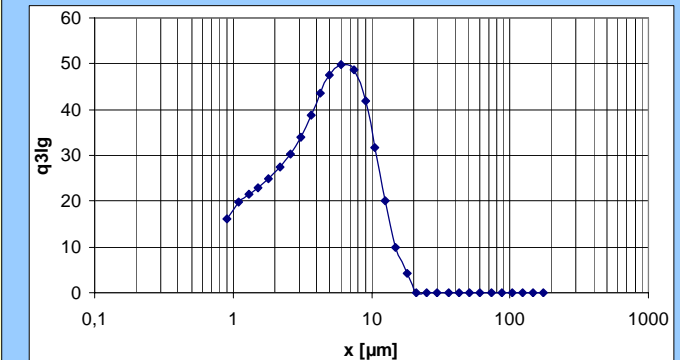


⇒ high financial losses

Process idea:



Sludge characterisation

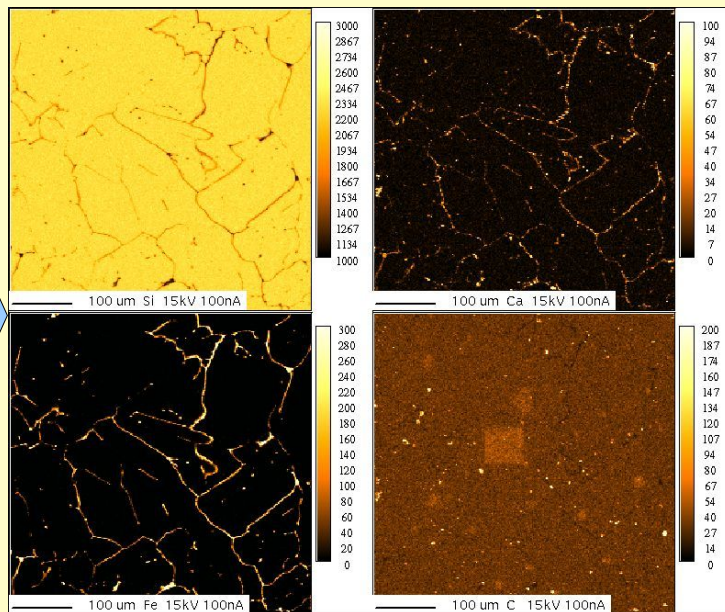


Si	SiO ₂	SiC	Fe	Cu	Zn
~ 41 %	~ 7,5 %	~ 45 %	~6,5 %	< 0,5 %	< 0,05 %

Si production in EAF - main reactions:

- $y \cdot \text{SiO}_2 + \text{SiC} = (2-y) \cdot \text{Si} + (2y-1) \cdot \text{SiO} + \text{CO}$
- $\text{SiO} + \text{SiC} = 2 \text{Si} + \text{CO}$

➔ risk of Si losses



EPMA Analysis of silicon

- ➔ complete reaction of SiC with SiO₂ to Si
- ➔ segregation of the impurities at the grain boundaries

Result:

- turning a waste to product - utilisation of the sludge as "new" feedstock for production of upgraded silicon