

High Performance Metal Solutions

# Thin Film Materials for the Solar Energy Market

H.C.Starck 

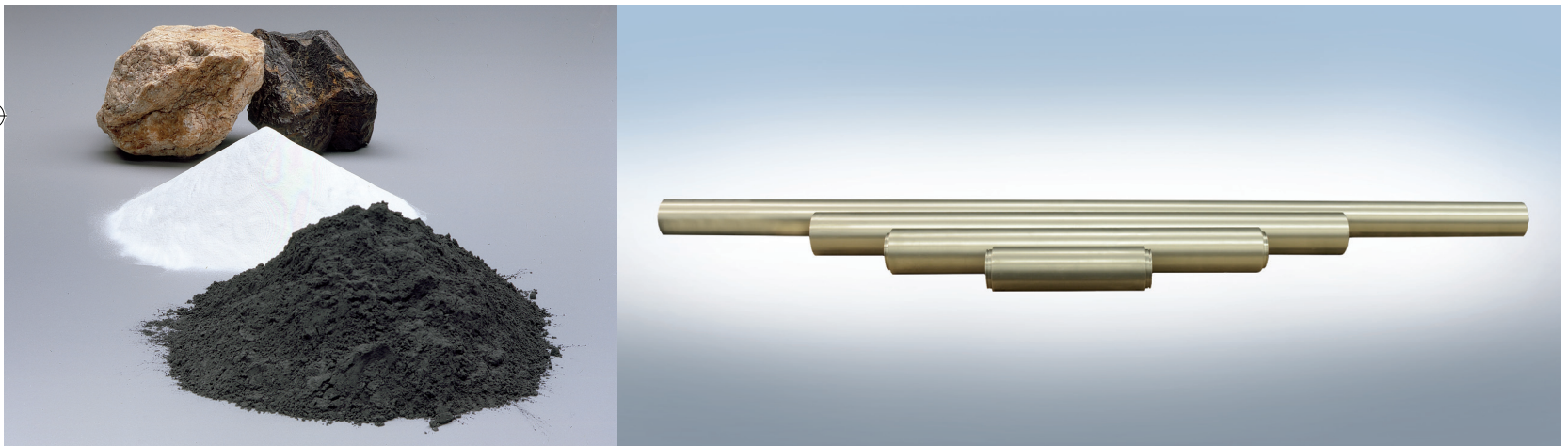
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# High Tech Materials for High Tech Applications

H.C. Starck has decades of experience in the production of high performance materials that provide solutions to demanding solar applications.

- > Molybdenum
- > Tungsten
- > Tantalum
- > Titanium
- > Niobium
- > Molybdenum alloys
- > Tungsten alloys
- > Nickel alloys

H.C. Starck is vertically integrated in the production of refractory metals from inorganic chemicals to finished products.



**Refractory metals have special properties for thin film applications:**

- > conductive but not magnetic and are easily sputtered
- > resistant to the harsh etchants used in device manufacturing
- > adhesion to substrates and subsequent layers is generally good
- > resistant to the diffusion of impurities
- > coefficients of thermal expansion that are similar to silicon
- > low residual stress (at optimum sputter conditions)

# Value-Added Product Solutions for the Solar Energy Market

The solar energy market has come of age. As the costs of fossil fuels skyrocket, the photovoltaic (PV) solar energy industry is predicted to enter a period of explosive growth. Experts in the field predict that larger and more efficient PV panels will be the norm as solar energy producers strive to reduce production costs.

Thin-film PV, which up until a few years ago was a much smaller segment of the PV industry, is now one of the most vibrant areas of the market.

H.C. Starck continues to play a significant role in this market. We manufacture rotary and planar sputtering target materials made of high-purity molybdenum for CdTe and CIGS based solar cells, and rotary NiV targets used for Si thin-film solar cells. We also produce target materials from titanium, niobium, and other materials. As the PV solar cell market changes, H.C. Starck will continue to be a leader. We conduct active research into new solar cell thin film materials technologies and we continue to expand our capabilities to produce rolled and machined plates and tubes.

Material	Potential PV Applications	Tubular	Planar
Mo	CIGS, CdTe, a-Si	✓	✓
Mo-Ti	Barrier Layer	✓	✓
W	Barrier Layer	✓	✓
WTi	Barrier Layer	✓	✓
NiV	CdTe, a-Si	✓	✓
Nb	Various	✓	✓
Ta	Barrier Layer	✓	✓



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