High Performance DynaMo™
Family of Sputtering Targets
DynaMo™ Sputtering Target Material Properties

H.C. Starck Solutions offers flat rolled planar sputtering targets with the highest density in the industry.

DynaMo™ sputtering targets were introduced to market for mobile FPD and TSD applications as a barrier layer and capping layer.

DynaMo™ MECHANICAL PROPERTIES

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density (g/cc)</td>
<td>10</td>
</tr>
<tr>
<td>Tensile</td>
<td></td>
</tr>
<tr>
<td>YTS 0.2% (MPa (ksi))</td>
<td>380 (55)</td>
</tr>
<tr>
<td>UTS (MPa (ksi))</td>
<td>560 (81)</td>
</tr>
<tr>
<td>% @ break</td>
<td>2</td>
</tr>
<tr>
<td>Hardness (HVN 5 Kg)</td>
<td>200</td>
</tr>
<tr>
<td>CTE (ppm/ºC)</td>
<td>TBD</td>
</tr>
<tr>
<td>Conductivity</td>
<td></td>
</tr>
<tr>
<td>Thermal (W/mºK)</td>
<td>210-250</td>
</tr>
<tr>
<td>Electrical (µΩ-cm)</td>
<td>6.4</td>
</tr>
</tbody>
</table>

Why Use H.C. Starck’s DynaMo™?

DynaMo™ offers many benefits in etching and corrosion resistance.

> Etch Compatibility

- DynaMo™ has the closest Etch rate to aluminum (Al) in PAN etchant compared to all molybdenum (Mo) alloys available in market
- DynaMo™ can be easily etched with copper (Cu) etchant, producing clean profile with controlled taper angle

> Corrosion Resistance

- DynaMo™ has 40-80% better Corrosion resistance in corrosive environments compared to molybdenum-niobium (MoNb) and molybdenum-tantalum (MoTa)

> Black Material

- DynaMo-Ox™ has Reflectivity less than 15%
- DynaMo-Ox™ is Etch compatible with Al
**DynaMo™ offers the “BEST” Etching Solutions**

**ETCH RATE IN PAN ETCHANT**

DynaMo-TSA™ etch rate in PAN etchant is the closest to Al at any given temperature.

**DynaMo™ Anti-Corrosion Properties**

Corrosion rate comparison of Mo alloy at 85 °C, 85%H

**GLASS (100 nm Mo alloy)**

DynaMo-TSI™ and DynaMo-TSR™ are specifically designed for Touch Sensor and Automotive Display applications. These materials perform 40-80% better in corrosive environments than MoNb and MoTa.
The DynaMo™ family of sputtering targets can be employed to create Black Oxide for Anti-Reflective coatings.

H.C. Starck Solutions’ patent pending solutions can be customized for each customer based on the customer’s specific requirements and capabilities.

**Solution 1** – Lower Reflection by engineering the grain size and surface morphology

**Advantages:**

- No need to change the sputtering target
- No need to use reactive gasses during sputtering
- Etch rate is not affected significantly
- No need for high temperature post-processing

**Disadvantages:**

- At 550 nm, Reflectivity will be about 40-60% depending on the deposition parameters.

H.C. Starck Solutions’ includes a very unique composition of DynaMo™ that enables surface engineering of grain size and packing density, resulting to Reflection < 25-35%.
**Solution 2** — Lower Reflectivity by Reactive Sputtering

**Advantages:**

- At 550 nm, Reflectivity < 10-15%
- No need to change Target

**Disadvantages:**

- Using Reactive gasses during sputtering

H.C. Starck Solutions’ patent pending DynaMo™ composition and its oxide are designed for etchant (e.g. PAN) compatibly to ensure that etch rate is not significantly affected regardless of metallic or oxide format.
Solution 3 – Post annealing in air at Temperature of 350 °C

Advantages:

- At 550 nm, Reflectivity < 0-10%
- No need to change sputtering target
- No need to use reactive gasses during sputtering
- Etch rate is not affected significantly, since only the top surface is being affected

Disadvantages:

- Post-process annealing step at high Temperature

H.C. Starck Solutions’ includes an annealing process at the 350 °C, which is similar to the curing step in FPD-TSP production setting.

GLASS (30 nm DynaMo™, 3000 nm Al and 30 nm DynaMo™)

![Graph showing the reflectivity of GLASS at different times and wavelengths.](image-url)
**Solution 4 – Lowering Reflectivity by Surface Modification: Anodization**

**Advantages:**

> At 550 nm, Reflectivity < 10-15%
> No need to change the sputtering target
> No need to use reactive gasses during sputtering
> Etch rate is not affected significantly, since only the top surface is being modified
> Room temperature post-processing step

**Disadvantages:**

> Only certain material/composition react to anodization process

H.C. Starck Solutions’ includes its patent pending anodization process for the DynaMo™ family of products. DynaMo™ would easily anodize using a low concentration of acidic/basic solution.

**GLASS (200 nm DynaMo™ and 3-5 nm Anodized DynaMo™)**

![Graph showing reflectivity vs. wavelength for GLASS with and without anodization.](image)
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