

How to Make Copper Sputter Target

This tutorial provides a detailed, step-by-step guide on how to manufacture copper sputter targets, emphasizing the transformation from raw copper ore to the finished target suitable for vacuum coating applications.

 Difficulté **Moyen**

 Durée **24 heure(s)**

 Catégories **Énergie, Science & Biologie**

 Coût **0 USD(\$)**

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Introduction

Copper sputtering targets are excellent sputtering materials in the vacuum coating industry. Sputtering targets are a special group of materials, especially for thin-film coating.

Matériaux

- Sulfide ore: chalcopyrite (CuFeS_2), porphyrite (Cu_5FeS_4) and chalcopyrite (Cu_2S).
- Oxidized ore: cupro ore (Cu_2O), malachite, $[\text{Cu}_2(\text{OH})_2\text{CO}_3]$, chrysocolla ($\text{CuSiO}_3 \cdot 2\text{H}_2\text{O}$).
- Natural copper

Outils

smelting, forging, rolling, and heat-treating

Étape 1 - Smelting and Purification of Copper Ore

The initial step in making a copper sputter target is smelting copper ore, which serves as the raw material. Copper ores are categorized into three types:

- Sulfide ores: chalcopyrite (CuFeS_2), porphyrite (Cu_5FeS_4), and chalcocite (Cu_2S)
- Oxidized ores: cuprite (Cu_2O), malachite $[\text{Cu}_2(\text{OH})_2\text{CO}_3]$, chrysocolla ($\text{CuSiO}_3 \cdot 2\text{H}_2\text{O}$)
- Natural copper

Copper ores with about 1% copper content (ranging from 0.5% to 3%) are economically viable for mining. Impurities such as gangue are removed by flotation to concentrate copper content to 8%-35%. The extracted crude copper is then purified through multiple electrolysis and regional melting processes to achieve high purity levels of 99.95%, 99.99%, 99.999%, and even 99.9999%.

Étape 2 - Forging, Rolling, and Heat Treatment of Copper Ingots

After purification, the high-purity copper ingots undergo mechanical processing including forging, rolling, and heat treatment. These processes refine the copper's microstructure by reducing crystal grain size and increasing density. This treatment is essential to meet the stringent requirements for copper sputter targets, ensuring uniformity and stability of the material during sputtering.

Étape 3 - Precision Machining and Final Shaping

Following deformation treatments, the copper material is machined to achieve high precision dimensions and superior surface quality. The final target is shaped to fit vacuum coating equipment specifications. Copper sputter targets are commonly available in planar (flat) and rotary (cylindrical) forms, with customized shapes also possible depending on application needs.

Notes et références

1. Sputter Targets. "Copper Sputter Target – An Excellent Sputtering Material." *Sputter Targets*, Stanford Advanced Materials, www.sputtertargets.net/blog/copper-sputter-target-an-excellent-sputtering-material.html. Accessed 30 May 2025.
2. Kanno, Isaku, et al. "Copper Sputtering Target Assembly and Method of Making Same." *US Patent* US6645427B1, 11 Nov. 2003. United States Patent and Trademark Office, patents.google.com/patent/US6645427B1/en. Accessed 30 May 2025.