Research
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HIGH-PURITY METAL FOILS FOR RESEARCH & ENGINEERING



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AN INTRODUCTION
HIGH-PURITY METAL FOILS

Many advanced engineering and research applications demand materials with precise physical, chemical, and electrical properties.

High-purity metal foils play a critical role in these fields by minimizing impurities that could compromise performance, making them essential for thin-film deposition, spectroscopy, catalysis, electrochemistry, biomedical sensors, and microelectronics. For instance, in surface science and spectroscopy, even trace impurities can significantly affect experimental outcomes, underscoring the necessity for high-purity materials.

Goofellow has recently expanded its portfolio to include over 1,200 new product SKUs of high-purity metal foils, featuring metals such as 99.995% Tantalum, 99.995% Titanium, 99.999% Copper, 99.999% Nickel, 99.999% Tin, 99.9999% Aluminum, 99.999% Gold, 99.999% Platinum, and 99.999% Silver. These foils, available in various thicknesses and sizes, are precisely engineered to meet the requirements of researchers and engineers across multiple disciplines.

WHEN TO USE HIGH-PURITY METALS AND FOILS

The choice to utilize high-purity metals and foils hinges on the specific requirements of a given application. In research settings, especially those involving thin-film deposition and surface analysis, the presence of impurities can lead to experimental variability and compromised data integrity. Similarly, in electrochemical applications, impurities in electrode materials can affect reaction kinetics and overall cell performance. Therefore, selecting high-purity foils is crucial when aiming to minimize contamination and ensure reproducibility in experimental results.

BASE METAL FOILS AND THEIR APPLICATIONS

Aluminum (99.9999% (6N) Purity): Ultra-high purity aluminum foils are critical in applications requiring excellent conductivity and corrosion resistance. Common applications include semiconductors and electronics or other specialized applications such as Molecular Beam Epitaxy (MBE), where the precise control of the composition and structure of the materials is crucial for the development of high-quality layered semiconductors. In electronics research, its high conductivity and low impurity levels make it an ideal material for capacitor electrodes, battery current collectors, and semiconductor processing, where even trace contaminants can affect device performance. Ultra-high-purity aluminum is also applied as a sputtered coating in the production of integrated circuits. In energy storage research, they are used as current collectors in lithium-ion batteries, contributing to improved battery performance.

High-purity 99.999% (5N) aluminum (Al) foil is essential in research and high-tech industries where minimal contamination is critical. In aerospace and defense applications, its lightweight nature, thermal stability, and corrosion resistance enable its use in radiation shielding, thermal insulation, and advanced coatings. This purity of aluminum is essential in environments that demand resistance to corrosive elements or extreme temperatures, such as cryogenic applications. At this level of purity, aluminum primarily functions as an electrical conductor, providing nearly twice the superior conductivity of copper when compared by weight. The biocompatibility and non-reactive properties of high-purity aluminum also support its use in medical and pharmaceutical research, including diagnostic equipment, implantable medical devices, and sterile packaging.

In nuclear physics and radiation research, high-purity aluminum foil has been used as a degrader, monitor, and catcher foil for determining the excitation functions of nuclear reactions induced by deuteron beams, ensuring accurate measurements with minimal interference from impurities[1]. Titanium foil has also been employed in these experiments as a monitor foil. Furthermore, aluminum foil serves as a highly effective substrate for the growth of nanostructures, providing a controlled surface for thin-film deposition, catalytic reactions, and functional coatings in nanotechnology research.[2] These characteristics make high-purity aluminum foil indispensable for applications requiring high reliability, precision, and stability in experimental and industrial settings.

TANTALUM (99.995% PURITY): Tantalum foils are highly valued for their corrosion resistance and high melting point, making them suitable for applications in chemical processing equipment and as components in high-temperature furnaces. Their biocompatibility also lends them to use in medical implants. In addition, such a high purity Tantalum can be used as an evaporation material in the deposition of thin metal film coatings for high temperature components and substrates used in aerospace and nanotechnology applications.

TITANIUM (99.995% PURITY): Titanium foils are utilized in aerospace applications due to their excellent strength-to-weight ratio and corrosion resistance. They are also employed in biomedical implants and devices, benefiting from their biocompatibility and mechanical properties. Additionally, titanium foams, derived from these foils, are explored for orthopedic implants, offering a porous structure that facilitates bone in-growth.

COPPER (99.999% PURITY): High-purity copper foils are essential in electronics for applications like printed circuit boards and electromagnetic shielding, owing to their superior electrical and thermal conductivity. In electrochemical research, they serve as electrodes in studies involving battery technologies and electroplating processes.[3]

NICKEL (99.999% PURITY): Nickel foils are employed in battery technology, particularly in nickel-cadmium and nickel-metal hydride batteries, serving as current collectors. Their corrosion resistance and mechanical strength also make them suitable for use in fuel cells and catalytic converters.

TIN (99.999% PURITY): Tin foils are widely used in soldering applications within the electronics industry due to their low melting point and excellent wetting properties. In research, they are utilized in studies involving superconducting materials and as protective coatings to prevent corrosion.



1. High-accuracy transmission and fluorescence XAFS of zinc at 10 K, 50 K, 100 K and 150 K using the hybrid technique., Marcus W. John, Daniel Sier,a Ruwini S. K. Ekanayake, Martin J. Schalken, Chanh Q. Tran,b Bernt Johannessen, Martin D. de Jonge, Peter Kappen and Christopher T. Chantlera, Journal of Synchrotron Radiation, 2023, 30, 147-168 https://doi.org/10.1107/S1600577522010293

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3. Sachin D. Giri and A. Sarkar. Electrochemical Study of Bulk and Monolayer Copper in Alkaline Solution, Journal of The Electrochemical Society, Volume 163, Number 3, https://iopscience.iop.org/article/10.1149/2.0071605jes#s1

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PRECIOUS METAL FOILS AND THEIR APPLICATIONS

GOLD (99.999% PURITY): Gold foils are extensively used in microelectronics for applications like wire bonding and as thin-film coatings due to their excellent conductivity and resistance to oxidation. In biomedical engineering, they are utilized in diagnostic devices and as biocompatible coatings for implants. Their stability and inertness make them suitable for use in harsh chemical environments.

Outstanding scientific research using high-purity gold (Au) foils has been conducted using element-specific techniques at synchrotron-radiation facilities. X-ray magnetic circular dichroism (XMCD) studies have demonstrated that gold can exhibit an induced magnetic moment when incorporated into alloys or layered-film structures with 3d ferromagnetic transition metals. This phenomenon is of particular interest in spintronics and nano magnetism, where gold's exceptional conductivity and stability make it a valuable material for investigating interfacial magnetic interactions and developing advanced electronic devices[4].

PLATINUM (99.999% PURITY): Platinum foils are integral to catalytic applications, including use in catalytic converters and fuel cells, due to their exceptional catalytic properties and chemical stability. In laboratory settings, they are employed as crucibles and electrodes in high-temperature experiments.

SILVER (99.999% PURITY): Silver foils find applications in advanced electronics and superconductors, benefiting from their superior electrical and thermal conductivity. They are also used in specialized optical coatings and as conductive layers in photovoltaic cells, enhancing the efficiency of solar panels.

WHAT PURITY METAL FOILS ARE AVAILABLE?

Goodfellow specializes in the precision manufacturing of thin metal foils, delivering exceptional quality and tight tolerance standards. With over 75 years of engineering expertise in rolled foils and strips, we offer a wide range of customized products tailored to our customers' specifications. Goodfellow offers metal foils in purities ranging from 9X-99.99X%.

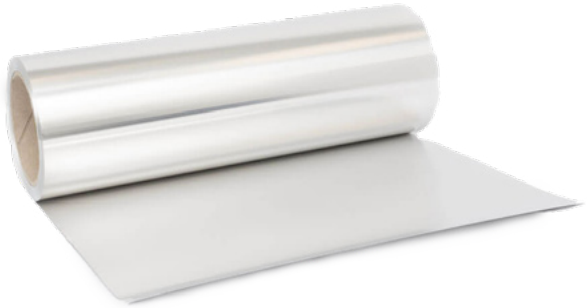
CHART SHOWING DIFFERENT METAL FOILS AND AVAILABLE PURITIES

METAL	AVAILABLE PURITIES	AVAILABLE NEW THICKNESSES FOR HIGHEST PURITY
Aluminium Foil	99.9999% Aluminum 99.9995% Aluminum 99.999% Aluminum 99.99% Aluminum 99.5% Aluminum 99.1% Aluminum 99% Aluminum	99.9999% 0.01mm, 0.025mm, 0.05mm, 0.1mm, 0.2mm, 0.3mm, 0.4mm, 0.5mm
Copper Foil	99.999% Copper 99.99% Copper 99.97% Copper 99.95% Copper 99.9% Copper	99.999% 0.01mm, 0.025mm 0.05mm, 0.075mm 0.1mm, 0.25mm 0.3mm, 0.4mm 0.5mm, 0.75mm 1mm
Tin Foil	99.999% Tin 99.99% Tin 99.95% Tin 99.75% Tin 98.8% Tin	99.999% 0.01mm, 0.025mm, 0.05mm,0.075mm, 0.1mm, 0.25mm, 0.3mm, 0.4mm, 0.5mm, 0.75mm
Titanium Foil	99.999% Titanium 99.995% Titanium 99.99% Titanium 99.6% Titanium	99.995% 0.01mm, 0.025mm, 0.05mm,0.075mm, 0.1mm, 0.5mm, 0.3mm, 0.4mm, 0.5mm, 0.75mm, 1mm
Tantalum Foil	99.999% Tantalum 99.995% Tantalum 99.99% Tantalum 99.9% Tantalum	99.999% 0.01mm, 0.025mm, 0.05mm, 0.1mm, 0.25mm, 0.3mm, 0.4mm, 0.5mm, 0.75mm, 1mm
Gold Foil	99.999% Gold 99.99% Gold 99.95% Gold 99.9% Gold	99.999% 0.1mm, 0.025mm, 0.3mm, 0.4mm, 0.75mm
Silver Foil	99.999% Silver 99.99% Silver 99.97% Silver 99.95% Silver 99.9% Silver	99.999% 0.1mm, 0.3mm, 0.4mm, 0.75mm
Platinum Foil	99.999% Platinum 99.99% Platinum 99.95% Platinum 99.85% Platinum	99.999% 0.1mm, 0.3mm, 0.4mm, 1mm

CONCLUSION

Goodfellow's expanded range of high-purity metal foils offers researchers and engineers materials that meet the rigorous demands of advanced scientific and industrial applications. By providing foils with purities up to 99.9999%, Goodfellow ensures that professionals have access to materials that can significantly reduce experimental variability and enhance the performance of their applications. Whether in the development of next-generation batteries, the fabrication of biomedical devices, or the advancement of aerospace technologies, these high-purity foils are poised to play a crucial role in driving innovation and achieving reliable, reproducible results.

In addition to providing top-tier materials, expert technical advice is available to help customers find the best solutions tailored to specific needs. Technical support includes assistance with technical drawings, metal data, specifications, and application information, ensuring informed decisions. Goodfellow also upholds rigorous quality standards, ensuring all metals meet industry certifications and regulations for reliable performance.





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