



Study of aurum determination in some alloys

Dr. Chhaya Chauhan ^{1*}, Chandani Pandey ², Deeptmani Dubey ³, Virendra Chawda ⁴, Sachin Upadhyay ⁵

¹⁻⁵ Department of Chemical Sciences, Christian Eminent College, Indore, Madhya Pradesh, India

* Corresponding Author: **Dr. Chhaya Chauhan**

Article Info

ISSN (online): 2582-7138

Volume: 04

Issue: 03

May-June 2023

Received: 26-03-2023

Accepted: 19-04-2023

Page No: 68-69

Abstract

With the atomic number 79 and the symbol Au (derived from the Latin aurum, "gold"), gold is a chemical element. This places it among the naturally occurring elements with higher atomic numbers. In its purest state, it is a vivid, slightly orange-yellow, thick, soft, malleable, and ductile metal. Aurum is a group 11 element and a transition metal in terms of chemistry. One of the least reactive chemical elements, it solidifies under normal circumstances. In rocks, veins, and alluvial deposits, gold frequently exists in its free elemental (native state), as nuggets or grains. It can be found naturally alloyed with other metals like copper and palladium, in mineral inclusions like pyrite, and in solid solution series with the native element silver (as in electrum). Less frequently, it appears as gold compounds in minerals, frequently with tellurium (gold tellurides). The gold alloys are inquarted with silver, compounded with lead and cupelled in a cupellation furnace until a precious metal button is obtained. After flattening and rolling, the silver is extracted (parted) in nitric acid and the gold weighed. Possible systematic errors in the procedure are eliminated by assaying standard proof samples in parallel. In this paper a review on aurum extraction from alloy has been presented.

Keywords: Aurum, alloys, extraction, BIS

Introduction

The term "white gold" is frequently used to describe these gold alloys. In the past, white golds were created from a patented gold-nickel-zinc alloy that was marketed as a platinum jewellery alternative and contained about 80% gold. It was instantly clear when the concept of white gold was extended to lower karat levels that some copper was necessary for workability at 18 karat and more copper for lower karat gold contents. Modern white gold is made from alloys in the gold-nickel-copper system that also contain 5–12 weight percent zinc. Similar to the gold-silver-copper system, this one also includes a two-phase immiscibility gap, but unlike that system, it is symmetrical around the copper content rather than the gold content. At various karat levels, white golds with fixed nickel-to-copper ratios differ from one another. Gold–nickel–copper based white golds work-harden faster and are harder after annealing than gold–silver–copper-based yellow golds. These alloys are very susceptible to fire cracking when they are given a full anneal after light cold-working. White gold compositions are the result of a compromise between color and fire cracking tendency. An increase in copper and a decrease in zinc contents have progressively led to a decrease in fire cracking tendency, while maintaining an acceptable color in the 10 karat and 14 karat white golds ^[5].



Fig 1: Common gold alloys, such Au-Ag, are malleable and soft [6]

Common gold alloys, such Au-Ag, are malleable and soft. In comparison to pure gold, gold-copper alloys are tougher, more fusible, and have higher tensile strengths. The iron-rich phase of gold alloys is ferromagnetic and has a lower melting point than pure gold. When iridium or rhodium is combined with ruthenium in fractional amounts, the grain size of the alloy is reduced, which increases its strength, hardness, and toughness.

In addition to the structured alloys, glassy metal, amorphous forms of gold have also been explored. Au₄Si, the first commercially available glass ribbon, La₈₀Au₂₀, Co₆₂Au₃₈, Fe₆₀Au₄₀, and Au-Ge-Si are all frequently cited. These glassy systems are created by quickly solidifying a liquid system while keeping the liquid's disorder. On heating, the glasses crystallise into an organised structure [3].

Cupellation - An oxidizing fusion of lead, gold, silver and associated base metals in a cupel which absorbs the lead oxide along with base metals oxides leaving a bead of gold and silver (along with platinum group metals, if any) on the cupel. 3.3 Fine Gold - It is gold having fineness 999 parts per thousand (%0) and above without any negative tolerance and free from Pb, Hg, Bi, Se, Te and platinum group metals. 3.4 Inquartation - The addition of silver to an assay sample to facilitate parting.

3.5 Parting - Separating silver from gold by selectively dissolving the silver in acid, usually nitric acid [4].

Materials and Methods

The majority of acids are resistant to gold, although it does dissolve in aqua regia (a solution of hydrochloric and nitric acids), generating a soluble tetrachloroaurate anion. Nitric acid alone dissolves silver and base metals, but gold is insoluble in it. This property has long been used to refine gold and determine the presence of gold in metallic compounds, giving origin to the term "acid test." In alkaline cyanide solutions used in mining and electroplating, gold dissolves. Additionally, gold can dissolve in mercury to make amalgam alloys, but because gold is merely a solute in this process, there is no chemical reaction [1]. Pure chemicals and distilled water or water of equivalent purity free from halides and suspended impurities been taken in the tests [5]. 'Pure chemicals that do contain impurities which affect the results of analysis. Anhydrous. 6.3 Pure Gold for Proof Samples, Dilute nitric acid specific gravity 1.2 (g/cm³) free from halides and suspended matter, Dilute nitric acid specific gravity 1.3 (g/cm³) free from halides and suspended matter have been used to carried out experiments. Two samples of the alloy have been transferred, preferably between 125 mg

and 250 mg weighed to the nearest into assay-grade lead-foil. The mass of the foil (or foil + beads) was 4 g for yellow gold samples up to 200 mg, and 6 g for samples from 20 mg to 300 mg (250 mg). Pure silver equivalent to 2.3 to 3 times the mass of fine gold present was added. It has been rolled and compressed to the lead foil into a tight ball. Duplicate determination gave results differing by maximum 0.5 parts per thousand (%0) by mass for yellow and red gold alloys. Maximum 1.0 part per thousand (%0) by mass for white gold alloys and maximum 0.2 parts per thousand (%0) by mass for gold alloys containing 990 (%0) or more gold. If the difference is greater than this, the assay has been repeated [5].

Result and Conclusion

When analyzing alloys with a fine gold content of 990 (%0) or more. The values of t. for the proof samples which run in parallel shall not differ by more than 0.04 mg. In comparison to pure gold, gold-platinum alloys offer better mechanical qualities and good corrosion resistance. Green, yellow, and red gold can be made by altering the proportions of gold, silver, and copper; Au-Ni-Cu(Zn) alloys are white golds. Elements from the main group, transition group, and several lanthanide elements have all been alloyed with gold. In order to deoxidize, lighten the colour, reduce the possibility of hardening during air cooling, and lower the melting point, zinc is frequently added to gold jewellery alloys. It is one of the least reactive chemical elements and normally solidifies. Gold frequently occurs as nuggets or grains in its free elemental (native state) in rocks, veins, and alluvial deposits. It can be found in solid solution series with the native element silver (as in electrum), naturally alloyed with other metals like copper and palladium, and in mineral inclusions like pyrite. Less frequently, it can be found as tellurium-rich gold compounds in minerals. By this review Requirements of proof gold sample have been revised. Purity of lead foil, bead has been kept at 99.9 percent minimum, requirements of assay balance can be modified [5].

References

1. Standard Atomic Weights: Gold. CIAAW; c2017.
2. Hubert Schmidbaur, John L. Cihonski, in Encyclopedia of Physical Science and Technology (Third Edition); c2003.
3. Weast Robert. CRC, Handbook of Chemistry and Physics. Boca Raton, Florida: Chemical Rubber Company Publishing.