

Micro-alloying of 24 ct golds: Update

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In the article, “Strong 24 carat golds: the metallurgy of micro-alloying” by C.W. Corti in *Gold Technology*, no 33, Winter 2001, pages 27-36, it was concluded that the majority of strong 24 carat gold materials that have been developed were based on hardening gold by calcium and rare earth metal additions. A comment was made that the basis for hardening the Mintek Hard 24 carat gold was unknown at that time.

A paper has been recently published in our sister journal, *Gold Bulletin* (volume 35 (2), 2002, pages 46-52) by du Toit *et al* of Mintek in South Africa on their Hard 24 carat gold. The paper, “The development of a novel gold alloy with 995 fineness and increased hardness” gives the metallurgical basis for hardening. Unlike the other strong golds, hardening is achieved by small additions of antimony and cobalt. These alloying metals are more conventional and less reactive than calcium and the rare earths and this makes alloy ingot production easier and the scrap recyclable. Thus, small- medium-jewellery producers should be able to make this type of alloy on their normal equipment.

The alloy is heat treatable and hardnesses of up to HV 140 can be achieved, Table 1. The mechanical properties are shown in Table 2. Whilst the alloy is highly formable and more amenable to the production of wrought jewellery, du Toit *et al* show that it is castable on an industrial scale. They also carried out coining trials to demonstrate its potential use for 24 carat coin manufacture.

For those wishing to see the original paper, it can be accessed on the World Gold Council website, www.gold.org, in the Science and Industry domain, *Gold Bulletin* archive.

Table 1 The Hardness of Pure Gold, 22 Carat Yellow Gold and the New 995 Alloy in a Number of Different Conditions (HV5:Points on the Vickers Hardness Scale; Applied Load of 5 kg)

Material	Annealed	Cold-worked	Aged
995 alloy	32 HV5	100 HV5 (70% reduction in thickness)	Peak hardness: 142 HV5 (hardened at 250°C) Peak hardness: 131 HV5 (hardened at 300°C)
Pure gold	22 HV5	73 HV5 (70% reduction in thickness)	Cannot be hardened by heat treatment to any appreciable extent
22 carat gold (11)	52 HV5	138 HV5 (75% reduction in thickness)	Cannot be hardened by heat treatment to any appreciable extent

Table 2 - Mechanical properties of the New 995 Alloy

	Annealed	Cold-worked (20% Reduction in Thickness)	Cold-worked (80% Reduction in Thickness)	Cold-worked (80% Reduction in Thickness) and Aged
Ultimate tensile strength	160 MPa	220 MPa	330 Mpa	360 MPa
Yield strength (0.2% proof stress)	40 MPa	210 MPa	330 Mpa	340 MPa
Elongation to fracture	46 %	Not available	Not available	12 %