United States Patent Office

3,004,849
Patented Oct. 17, 1961

3,004,849

ZIRCONIUM ALLOYS

Thomas Raine, Bramhall, and James Alan Robinson, Cheadle, England, assignors to Associated Electrical Industries Limited, London, England, a British company

No Drawing. Filed June 6, 1960, Ser. No. 33,939
Claims priority, application Great Britain June 11, 1959
2 Claims. (Cl. 75—177)

This invention relates to alloys suitable for use in an aqueous medium at high temperature, and in particular for use in nuclear reactors of the pressurized water or boiling water type.

It has been shown that zirconium alloys containing tin have good resistance to corrosion in high temperature water and steam. Recent work on zirconium alloys containing copper has shown that such alloys have a high degree of film stability under these conditions of corrosion, although initially their weight gains are slightly higher than equivalent alloys containing tin.

We have now found, however, that when long exposure to the aqueous medium is required, zirconium alloyed with both copper and tin gives much improved corrosion resistance properties as compared with zirconium alloyed with tin alone, or with other alloys of zirconium.

An alloy according to the invention consists of zirconium with from 0.75% to 1.25% copper and from 0.25% to 0.75% tin, by weight.

A preferred alloy according to the invention is that containing 1.0% copper and 0.5% tin, the remainder being

zirconium, except for impurities which may be contained in sponge zirconium from which the alloy is produced.

As one example of the improved corrosion resistance of the alloys of the invention, we may give the following particulars.

An alloy known as Zircaloy–2, and consisting of 1.3–1.6% tin, 0.07–0.2% iron, 0.05–0.15% chromium and 0.03–0.08% nickel with remainder zirconium when exposed to steam at a pressure of one atmosphere and at a temperature of 500° C., gave a weight gain of 7.8 mg./cm.^{2} after 450 hours' exposure. In contrast to this, a zirconium alloy containing 1.0% copper and 0.5% tin, when exposed under the same conditions at for the same period showed a weight gain of only 1.2 mg./cm.^{2}. This example shows that the corrosion resistance of the improved alloy is about seven times better than that of the known alloy.

What we claim is:

1. An alloy consisting of zirconium with from 0.75 to 1.25% copper and from 0.25 to 0.75% tin, both being by weight of the total alloy, which alloy contains no other constituents than unavoidable impurities.

2. An alloy consisting, by weight, of 0.5% tin, 1.0% copper, with remainder zirconium except for unavoidable impurities.

References Cited in the file of this patent

AECU–3561, Scaling of Zirconium and Zirconium Alloys, August 1957, United States Atomic Energy Commission (available from Office of Technical Services).