# Science Notes.

## THE RARER METALS AND THEIR ALLOYS.

If to any of our readers the subject "The Rarer Metals and their Alloys" should seem to lack either interest or importance we cannot find any better means to dispel that illusion than to give some account of the very remarkable lecture (bearing the above title) which was recently delivered at the Royal Institution by Prof. Roberts Austen, C.B., F.R.S.

"The study of metals," said the Professor, "possesses an irresistible charm for us quite apart from its vast national importance. How many of us made our *first* scientific experiment by watching the melting of lead, but it would hardly have been a bad life's work if the experiment had been our *last* provided we had understood its full significance. How few of us forget that we wistfully observed at an early age the melting in an ordinary fire of some metallic toy of our childhood, and the experiment has, like the 'flat iron for a farthing' in Mrs. Ewing's charming story, taken a prominent place in literature which claims to be written for children. Hans Andersen's fairy tale, the 'History of a Tin Soldier,' has been read by children of all ages, and of most nations. The romantic incidents of the soldier's eventful career need not be dwelt upon, but I may remind you that at its end the tin soldier perished in the flames of an ordinary fire, and that all that could subsequently be found of him was his heart. There is no reason to doubt the perfect accuracy of the story recorded by Andersen, who at least knew the facts, though his statement is made in popular language. No analysis is given of the soldier—in a fairy tale it would have been out of place—but the record is sufficient to enable us to form the opinion that he was composed of both tin and lead, certain alloys of which metals will burn, like tinder, to ashes. His uniform was doubtless richly ornamented with gold lace. Some small amount of one of the rarer metals had found its way into his constitution, and it, uniting with the gold, formed the heart-shaped mass which no ordinary fire would melt; and the temperature of the fire did not exceed 1000° (Centigrade), for we are told that the golden rose, worn by the artist who shared the soldier's fate, was also found unmelted.

"The main point, however, is that the presence of one of the rarer metals must have, as the history shows, given to the soldier his singular endurance, and in the end left an incorruptible record of him.

"I have taken this," explained the Professor, "as the starting point of my lecture, because we shall see that the ordinary metals so often owe remarkable qualities to the presence of a rarer metal which fits them for special work.

"This early love of metals which is implanted in us is part of our 'unsquandered heritage of sentiments and ideals which has come down to us from other ages.'

"Future generations of children will know far more than we did; the attempt will be made to teach them that even psychology is a branch of molecular physics, and they will see far more in the melted toy than a shapeless mass of tin and lead. It is no inert thing: for some time after it was newly cast it was the scene of intense molecular activity. It probably is never really molecularly quiescent, and a slight elevation of temperature will excite in it a new rapid atomic movement. The nature of such movement I have indicated on previous occasions, when, as now, I have tried to interest you in certain properties of metals and alloys. This evening, I appeal incidentally to higher feelings than interest by bringing before you certain phases in the 'life history' of metals, which may lead you to a generous appreciation of the many excellent qualities which they possess.

"Metals have been sadly misunderstood; they are not the dull quiescent things they are usually supposed to be. The molecular movements induced by an elevation of temperature and alluded to above, can be readily detected, and can be measured by the methods which have proved to be so fruitful when applied to the study of living things. Just as changes of tissue in living organisms are revealed by a rise or fall in temperature, so molecular changes in metals are attended by an evolution or absorption of heat, and, with the aid of a suitable instrument, we now take the temperature of a mass of metal or alloy in which molecular disturbance is suspected to lurk, as surely as a doctor does that of a patient in whom febrile symptoms are manifested."

Passing to the rarer metals, Prof. Roberts Austen stated that these might be divided into two classes—those of the platinum group, which occur in nature in the metallic state, and those which are usually found as oxidised compounds, such as chromium, manganese, vanadium, tungsten, titanium, zirconium and molybdenum. Of the platinum group he proposed to say but little, though by the kindness of Messrs. Johnson & Matthey he exhibited specimens of platinum, of palladium, of iridium, osmium and rhodium, such as no other nation could show, and he stated that the examples exhibited were worth no less than £10,000.

Passing to the other rare metals, Prof. Roberts Austen described and illustrated by very effective experiments the method of reducing the oxides of titanium, chromium and molybdenum in the electric furnace, which had recently been employed in France by M. Moissan, who had sent for the purpose of the lecture beautiful specimens of these metals. It was pointed out that the future of these metals would probably be brilliant, since the only members of the series which had been known sufficiently long to have found their way into industrial use, had already done great service when alloyed with iron. The extraordinary power of penetration possessed by steel projectiles containing chromium, and the resistance of armour plates containing nickel were described at length. Reference was also made to the use of aluminium in the construction of torpedo boats, and it was shown that aluminium could not be used in the unalloyed state. Messrs. Yarrow had made an excellent torpedo boat of an alloy of aluminium with 6 per cent. of copper, but it remained to be seen whether aluminium alloyed with 2 per cent. of the rare metal titanium would not be preferable. After illustrating by some very delicate experiments the part which rare metals might be expected to play in alloys, Prof. Roberts Austen pointed out that in steel it was impossible to dissociate the action of the rarer metal from that of carbon, which was a protean element, and could exist in iron either in the dissolved, the graphitic, or even the diamond form. The Professor then showed on the screen some minute diamonds which, following M. Moissan's experiments, he had prepared by the suitable treatment of carburised iron.

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