The authors hope that these experiments may prove of use in affording an indication of the comparative behaviour of this "ἀριστο-κρατία" or noblest metal platinum, with the behaviour of the constructive metals, copper, nickel, iron and steel, when under the influence of stress; and the experiments have also shown that the microscopic influences of stress in the heavy metal platinum are analogous to those which have been observed in metals of lower specific gravity.

DESCRIPTION OF PLATE.

Fig. 1.—Microscopic Effects of Compression Stress on Platinum, showing Crystalline Slip, as seen in Section. Magnification 120 diameters. Vertical illumination. Metal compressed 10 per cent. Arrow indicates direction of compressive force.

Fig. 2.—Microscopic Effects of Compression Stress on Platinum, showing Crystalline Slip, as seen in Section. Magnification 120 diameters. Vertical illumination. Metal compressed 10 per cent. Arrow indicates direction of compressive force.

Fig. 3.—Same as fig. 2, but magnified 250 diameters.

"A Note on the Recrystallisation of Platinum." By WALTER ROSENHAIN, B.A. (Cantab.), B.C.E. (Melbourne). Communicated by Professor EWING, F.R.S. Received May 1,—Read May 15, 1902.

In a recent paper* Professor Ewing and the present author have described phenomena of recrystallisation in a number of metals, such as lead, tin, zinc, and cadmium, at temperatures well below the melting points of those metals. I have recently observed phenomena which appear to me to be of a very similar nature in the case of platinum.

It is a well-known fact that a prolonged exposure to a high temperature renders platinum brittle, and that the surface of such platinum, when it has been exposed to flame, shows markings "resembling the appearance of galvanised iron." † This phenomenon has generally been ascribed to the action of carbon, and by one author specifically to the action of acetylene.† Having studied the phenomena closely with the aid of the microscope, I do not find this view entirely confirmed.

In the first place, on examining the surface of the "changed" platinum with the microscope, it is seen to show a pattern which is

* "On the Crystalline Structure of Metals," second paper, 'Phil. Trans.,' A, 1900, vol. 195, pp. 279—301.

† "The Action of the Acetylene Flame on Platinum," J. J. Redwood, 'Soc. Chem. Industry Journ.,' vol. 17, p. 1107; also 'Zeitschrift für Analyt. Chem.,' 1901, heft 6, p. 411.

characteristic of the *etched* surface of a crystalline metal. The micrographic appearance under oblique light is shown, magnified 30 diameters, in the photograph (fig. 1). This was taken from the surface

Fig. 1. Surface of a Platinum Crucible after prolonged heating. Oblique light. Magnification, 30 diameters.

of a platinum crucible which has been in continuous use and is frequently exposed for hours together to an ordinary blowpipe flame. A closer examination revealed a multitude of geometrical pits (Aetzfiguren), clearly demonstrating that the appearance is due to genuine metallic crystals which have been *etched* on the surface by some chemical agent. Two other experimental facts confirm this idea. The first is that if a piece of platinum showing the "changed" surface be exposed to the action of aqua-regia, the appearance is intensified and brightened. If, as has been suggested, the appearance were due to a superficial layer of a platinum-carbon compound from which the carbon had been driven off, leaving mere pseudomorphs of platinum, the etching action of the aqua-regia would have dimmed the appearance instead of brightening it. Another objection to the carbonisation theory is to be found in the fact that I have produced the effect on a *new* platinum crucible by prolonged heating in an oxygen injector furnace, where an oxidising atmosphere was being maintained.

The "changed" platinum is, moreover, very weak and brittle when hot, and on one occasion a crucible was torn whilst still red hot, but after being removed from the flame. The fracture was as crystalline

as that of "brittle" zinc, and the lines of fracture ran across the crystals revealed on the changed surface in such a way as to show that these crystals seen on the surface are not a thin superficial layer, but genuinely represent the entire structure of the metal.

I am therefore led to the conclusion that the action is simply one of recrystallisation. The metal in the state in which it reaches us in foil or crucibles, &c., is in a condition of severe strain, having been bent, drawn, rolled, &c., either in the cold or at temperatures far below its "annealing" temperature. This is supported by the fact that the platinum in its "unchanged" state shows a very minute structure characteristic of severely strained metals. The natural effect of exposure to a high temperature of metal in such a condition is to allow it to recrystallise, and this I conceive to be what occurs in the case of platinum. The brittleness of the "annealed" metal is not at all surprising, as the same phenomenon occurs with zinc and cadmium (see paper cited above). In the case of platinum "annealed" in a gas flame there is, however, a further action; simple annealing or recrystallisation, although it will completely alter the interior structure of a piece of metal, will not of itself alter the appearance of the surface even in microscopic detail. To develop a surface pattern corresponding to the changed internal structure the surface must be *etched after* the recrystallisation has taken place. The etching action is in this case undoubtedly due to the gases of the flame, and the temporary formation of a carbide may play a part in this process.

"On some Phenomena affecting the Transmission of Electric Waves over the Surface of the Sea and Earth." By Captain H. B. JACKSON, R.N., F.R.S.

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In 1895, systematic experiments were commenced by me with a view of utilising the effect of Hertzian waves on imperfect electrical contacts, for naval signalling purposes.

I soon observed that some unexpected phenomena were deterrent factors in obtaining the necessary accuracy at all times, and with the most modern and improved instruments that we now possess, this is equally noticeable.

The results of some of the phenomena are described in this paper, with the conclusions that I have drawn as to their cause.

Some of the experiments described were specially conducted with the object of elucidating definite results on the subject. Other experiments carried out with a different object, and also ordinary practical signalling at various times, also gave the results described, without in

FIG. 1. Surface of a Platinum Crucible after prolonged heating. Oblique light. Magnification, 30 diameters.