æther of classical physics, represents a variable 'effective optical length' for standing waves, depending on the angle between that velocity and the axis. Therefore, according to classical optics it ought to be impossible to keep the resonant frequency of a cavity resonator constant for any length of time if the resonator is fixed in a certain position in the laboratory; for the orientation of its axis relative to the earth's velocity with respect to the æther changes in the course of the day and the year. The resonant frequency would in general change periodically between two limits during one stellar day, and the frequency-range would periodically expand and contract annually, reaching its greatest width when the directions of the earth's orbital movement and of the movement of the solar system coincide.

Analysis of records of frequency fluctuations of a stationary cavity resonator could in principle give information on whether an æther drift exists; but it is most probably not possible to keep the system free from external disturbances for a sufficient length of time.

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Transformation in a Titanium - Chromium Alloy

In metallic systems which may undergo a diffusionless (or martensitic) transformation on cooling, it has been found that transformation may also be induced above M_s by plastic deformation under favourable conditions[1]. The phenomenon has been investigated exhaustively in steels and in one or two non-ferrous systems; but its study in titanium alloys has received little attention up to now. Many titanium systems show a very interesting phenomenon in that a rather abrupt drop in M_s occurs when the alloy content is increased above a certain critical value[2]. Such an effect is not to be expected from general thermodynamic considerations of the constitution diagrams and has been attributed to the occurrence of some form of stabilization[3]. To examine this in greater detail, an investigation was made of the effect of deformation on a titanium – 10 per cent chromium alloy, for which, according to extrapolation of known data, M_s should be about 200° C.[2], although the alloy can be cooled down to – 196° C. without transformation occurring.

The alloy used was arc-melted in an inert gas (argon) atmosphere and received in the fully β-condition, as metallographical and X-ray examination confirmed. Specimens about $\frac{1}{16}$ in. × $\frac{1}{4}$ in. × $\frac{1}{2}$ in. were cut off under water and deformed by compression between two steel blocks; low-temperature deformation was carried out by surrounding the specimen and blocks with liquid nitrogen. X-ray examinations were made at room temperature using filtered copper $K\alpha$ radiation and an aluminium foil 0·002 in. thick placed over the photographic film to absorb the secondary radiation. The surface of the specimens were electrolytically polished and set at an angle of 20° to the incident beam, with an oscillation to 25°, in a cylindrical camera of 10 cm. diameter.

Room temperature deformation (expressed in terms of true stress and strain) up to 20 per cent (corresponding to a stress of about 150 kgm./mm.^{2}, 210,000 psi) produced no transformation of the body-centred cubic structure. The diffraction pattern obtained from the electropolished surface of the specimen parallel to the compression axis showed only spotty body-centred cubic lines due to coarse grain size. The same result was obtained after a heat treatment of 42 hr. at 1,100° C. (to eliminate any inhomogeneity that might have existed in the alloy as received) followed by quenching in 20 per cent sodium hydroxide solution at 10° C., and then deforming at room temperature.

Similarly, deforming at – 196° C. until fracture occurred (at about 17 per cent strain and 175 kgm./mm.^{2}, 250,000 psi) gave no definite evidence of transformation either, judging by the X-ray pattern from the fractured surface. By pre-straining (in compression), however, approximately 2 per cent at room temperature prior to the sub-zero deformation quite definite diffraction lines of the hexagonal close-packed structure were discovered in addition to those of the body-centred cubic structure; the sub-zero deformation was produced at – 196° C. by a stress not much above 200 kgm./mm.^{2} (300,000 psi), at which the specimen fractured (the amount of deformation could not be measured as the specimen fell apart on removing it from between the deformation blocks).

These observations confirm that the β-phase is very stable thermodynamically, and in addition indicate that it has also considerable mechanical stability, which, however, may be influenced under certain conditions.

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A Light Source for Köhler Illumination

The advantages of Köhler illumination have recently been discussed by Barer and Weinstein[1], and also the difficulties involved when a single auxiliary lens is used. They describe a new microscope lamp with a variable auxiliary lens-system which overcomes these difficulties. For most purposes, however, a single auxiliary lens can be used if a sufficiently large and reasonably uniform light source is available. This can usually be obtained without serious loss of light if a piece of ground glass can be placed very close to the filament of a suitable car headlamp bulb or projector bulb; but unfortunately, in most lamps, whether commercially available or home constructed, it is difficult to arrange this. A satisfactory method is to grind lightly a circular patch on the end of the bulb, using a mixture of fine well-worn 'Carborundum' powder and water on a glass plate. It is not suggested that this provides so versatile an illuminant as that described by Barer and Weinstein; but it does enable an ordinary so-called 'research' lamp to be used for Köhler illumination with medium- and high-power objectives, while if the auxiliary lens is of large diameter it will also illuminate most of the field of low-power objectives.

A bulb treated in this way is also very satisfactory with a field diaphragm as a source for 'critical'