γ -Rays of Radium-D

A CAUCHOIS type of curved crystal spectrometer¹ has been employed to study the γ -radiation from radium-D using a 100-mC. source.

The source was produced at the Radiochemical Centre, Amersham, by anode deposition on a dished platinum foil of area $\frac{1}{4}$ sq. in. The total weight of inactive deposit was 2.1 mgm. An aluminium foil of thickness 0.05 mm. was sealed over the source. The β -particles of radium-E were absorbed in a filter-paper screen of superficial mass 0.45 gm./cm.².

The γ -spectrum was recorded on Ilford G 5 nuclear plates coated to a thickness of 200 μ . The developed plates were scanned by microphotometer and the resulting observations were corrected for absorption before the photographic plate and for variation of the sensitivity of the photographic plate with wavelength. Exposures of 700 hr. were made, covering at full aperture the energy ranges 62–19 keV. and 50–16 keV. The well-known γ -ray was found at 265.96 ± 0.13 X.U. or 46.52 ± 0.02 keV., in good agreement with earlier observations² recalculated on the basis of recent values of the physical constants³. No other γ -ray was observed between the upper limit of observation at 62 keV. and the upper limit of the L X-ray spectrum of radium-E (L_{γ_4}) at 16.2 keV. γ -Rays within this region have been reported by various authors^{4,5}, though inconclusive or negative results have been obtained by others¹.

The upper limits set by our observations to the intensities of the γ -rays reported by Tsien⁴ relative to the intensity of the 46-keV. line are as follows:

Energy of γ -ray (keV.)	46.5	42.6	37	31	23.2	16.1
Relative Intensity	1	≤ 0.015	≤ 0.015	≤ 0.015	≤ 0.025	≤ 0.06

A full account of the experimental technique and of other measurements will be published at a later date.

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Growth Spirals and their Relation to Crystal Habit as Illustrated by Apatite

THE observation of growth spirals, as predicted by the theory of Burton, Cabrera and Frank¹, on prism faces (1010) of apatite crystals, has been reported earlier². We have now observed completely differently shaped growth spiral patterns on tabular colourless apatite crystals from Sulzbachtal (Austria), which have probably grown from solution. The accom-

Fig. 1

panying photograph (Fig. 1) shows one of the observed patterns. The direction of the c -axis is vertical. The shape and orientation of the spiral are the same in all cases. The dominating system consists of two co-operating spirals, which dominate several other dislocations of equal and of different strengths. In the latter case the formation of residual steps is noticed. Interlacing occurs in one direction. The main growth-fronts have a step-height of 140 ± 20 Å.

By introducing a two-dimensional reference system with the apatite parameters $c : a = 0.73 : 1$ as units, indices similar to the Miller indices for planes can be given to the growth fronts. These are, respectively, 01, 11, 10, $\bar{1}\bar{1}$, $0\bar{1}$, $\bar{1}\bar{1}$, $\bar{1}0$ and $\bar{1}\bar{1}$. Perpendicular to these directions we consequently have eight sharp minima for the growth velocity, and the following relations exist: $v_{10} > v_{01} = v_{0\bar{1}} > v_{\bar{1}0} = v_{\bar{1}\bar{1}} > v_{1\bar{1}} = v_{\bar{1}1}$. The subsequent polar diagram has only a line of symmetry perpendicular to the c -axis, which is consistent with the crystal class of apatite. The spirals are oriented in the same way on the six prism faces, proving the presence of a hexad symmetry axis.

When comparing the shape of the spirals described earlier and the shape of the present ones with respect to the habit of the crystals, a striking similarity will be noticed between the outline of the prism faces and the shape of the spiral growth fronts. This relation is shown schematically in Fig. 2, where (a) represents

Fig. 2