THE UNIVERSITY OF LIVERPOOL

TELEPHONE: ROYAL 6301

DEPARTMENT OF APPLIED MATHEMATICS

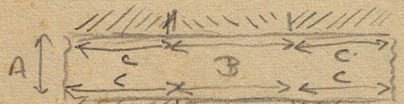
en route to:
Division of Electrotechnology
National Standards Laboratory
University Grounds
City Road
Chippendale, N.S.W., Australia

Dec. 29th, 1948.

Prof. K.S.Krishnan,
Director
National Physical Laboratory
University Buildings
Delhi

Dear Prof. Krishnan,

Some two years ago when you were visiting Bristol you mentioned your experiments on the conductivity of graphite crystals, and some time later we discussed the evaluation of your results by means of a conformal transformation. You told me that you were not sure if you had all the data available necessary for the calculations, but would look into the matter when you returned to India. Since then I have been very busy lecturing at Liverpool University, and as Dr. Bhatya told me you have been very busy with your new position. As I am going out to Australia now to a research post on dielectrics, I should be very grateful to know whether your previous data are sufficient to calculate the conductivity along the crystal planes. I just repeat which data are necessary if the crystal is mounted symmetrically both as regards sides and top and bottom.



A the thickness of the crystal
B the length of the insulator
C the lenght of contact of ~~and~~ electrode and crystal

further the width of the crystal and the conductivity at right angle to the planes.
If the crystal is not quite symmetrical as regards sides, the calculations are slightly more difficult, but can still be done; but symmetry between top and bottom is quite essential. I forget if you have made any measurements on the thermal variation of conductivity; this should be most important in the light of Wallace's and Coulson's calculations.

Yours Sincerely

Robert A. Sack

THE UNIVERSITY OF LIVERPOOL

TELEPHONE: ROYAL 6301

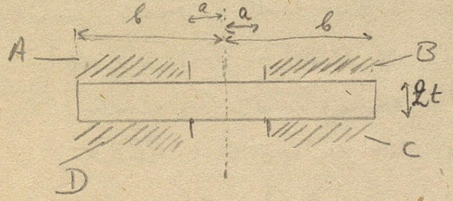
DEPARTMENT OF APPLIED MATHEMATICS

March 13th, 1947

Dear Prof. Krishnan,

During your visit to this country last summer we discussed the mathematical evaluation of the data obtained by you in your experiments on the conductivity of graphite. You mentioned that unless you were going to repeat these experiments, you would let me see your results for the purpose of evaluation. I am writing to you to let you know that I have left Bristol several months ago and am now employed at the University of Liverpool.

May I just point out once more the data necessary to calculate



the conductivity σ_x in the direction of the graphite planes. Besides the thickness $2t$ of the crystal and the width of the gap $2a$ we must know the length of the crystal $2b$, and the transverse conductivity σ_z. If the electrodes do not touch the crystal over the whole range $a \leq |x| \leq b$, but only between $|x| = a$ and $|x| = b$ the calculations are just as simple, but if there is any asymmetry, i.e. the centre of the gap not coinciding with the centre of the crystal, the calculations become a good deal more awkward, though they can still be done by the same method.

Another point over which I have puzzled is the question of contact resistance; you stated that the total resistance varies sometimes as the pressure on the electrodes is reduced, and that this is ~~mostly~~ likely due to contact resistance, though a variation of the conductivity with pressure may also play some part. For the latter possibility an easy criterium can be found: If the electrodes A and D are at the same potential, and also B and C, the resistance is proportional to $\frac{1}{\sqrt{\sigma_x \sigma_z}}$ provided the crystal is thick enough, i.e. if we have saturation of current; the factor of $\frac{1}{\sqrt{\sigma_x \sigma_z}}$ depends on the geometry of the crystal only. If, however, the electrodes A and B are at a common p.d. with regard to ~~A&B~~ C and D, the resistance is obviously $\frac{1}{\sigma_z}$ × geometric factor. As there is no apparent reason why σ_x should vary with a pressure in the z-direction, the resistance to a current across the crystal planes should vary as the square of the resistance to a current whose main direction is along the planes. If such a relation can be found experimentally, this would prove that the dominant factor in the pressure dependance is a change in conductivity, ~~other~~ if not, the effect is due to contact resistance.

Yours Sincerely

Robert Sack