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Publication Date
1951-02-06

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UCRL-1118
Technology - Materials
Testing Accelerator

UNIVERSITY OF CALIFORNIA
RADIATION LABORATORY

Contract No. W-7405-eng-48

CALIFORNIA RESEARCH & DEVELOPMENT COMPANY
Contract No. AT(11-1)-74

MINUTES OF MTA PROGRESS MEETING HELD FEBRUARY 6, 1951

Russell H. Ball

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RESEARCH SERVICE BRANCH
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MINUTES OF MTA PROGRESS MEETING
HELD FEBRUARY 6, 1951

Present: UCRL: Alvarez, Baker, Brobeck, Byerly, Cooksey, Cork, Gordon, Hanson, Kilpatrick, Latimer, Lofgren, Longacre, Martinelli, McMillan, Norton, Nelson, Reynolds, Street, Thornton, Twitchell, Wallace

CRDC: Chambers, Cane, Fossati, Gaylord, Hansen, Maker, Powell, Strom

AEC: Ball, Fidler, Derry, Flaherty

G.E.: Smith, Webster

Westinghouse: Andrews, Hague, Hulse, Kresser, Witzke

NAA: Edziak, Howard, Taylor

Baker said that an additional set of X-ray photographs of the B-1 cavity have been taken. They were taken with two separate cameras in order to obtain a stereoscopic view of the point sources of X-rays within the cavity. A comparison of these photographs with the original ones taken several weeks ago shows them to be substantially identical, with the exception that one intense spot is missing and a new one has taken its place at a different location. The new spot is less intense than the one which has disappeared. It is not possible to take advantage of the stereoscopic view obtained because the separation between the two cameras was too large. It is planned to take additional stereoscopic views and utilize a stereoscopic viewer available at the UC Hospital in San Francisco. Brobeck said it is hoped that the X-ray production may diminish after prolonged operation. It is hoped shortly to have the B-1 cavity in a condition in which sustained runs of 24 hours or more can be achieved to test this hypothesis. Also arrangements will be made to run a glow discharge in an attempt to clean up the tank.

Thornton discussed recent attempts to improve the voltage which can be held in the XC in the presence of strong magnetic fields. Following the initial discovery of the difficulties involved in holding high voltages on XC a number of measures were tried in the hope of improving matters. As previously mentioned, the first of these was the installation of water-cooled copper sections in the side panels adjacent to the high voltage electrode. This proved fruitless. Next, sheets of tantalum were used to cover the portion of the side panels adjacent to the tip of the electrode. This resulted in transferring the region of most severe sparking from the area adjacent to the tip of the electrode to that area not protected by the tantalum. Recently graphite surfaces have been installed and with these it has been found possible to maintain electrode voltages of one million volts both with and

without the presence of the magnetic field. Since graphite has a poor electrical conductivity it is hoped to avoid its use as a lining material for the full-scale Mark III machine. It is planned to investigate the utility of graphite-copper mixtures fabricated by powder metallurgy. Mixtures having as much as 75% copper have been used commercially as bearings and as brushes in the electrical equipment. It was also suggested that techniques be investigated for the copper plating of thin graphite sheets which could then be bonded to large copper sections. It is also planned to test the behavior of tungsten.

Alvarez said that the thickness of the copper cladding on iron required for minimum RF losses is approximately 1-2 skin depths. Since the skin depth at 12 megacycles is about 0.7 mil, a copper plating of one mil or more will prove satisfactory from the standpoint of RF conductivity. Figure 1 shows a plot of resistivity, in units of the h.f. resistivity, as a function of the thickness of copper plating upon an iron backing.

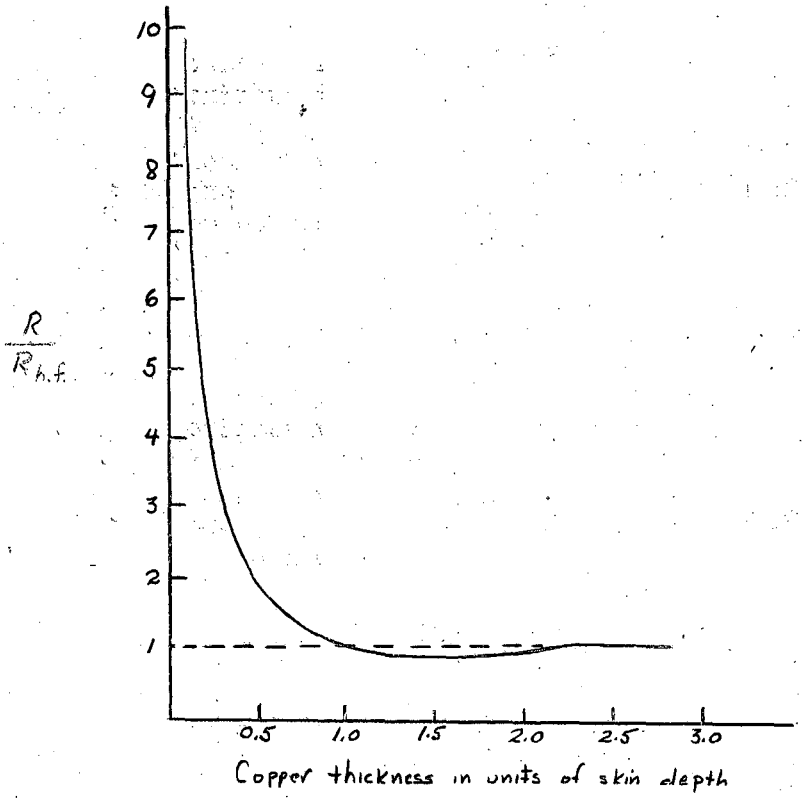

Figure 1.

Alvarez called attention to the fact that there is a 10% improvement in conductivity over that of pure copper at a thickness of about $1\frac{1}{2}$ skin depths.

An additional 5% improvement could be obtained by plating with silver rather than copper. This effect is due to a resonance phenomena and is interesting although it may not prove practical to take advantage of it in view of the thinness of the cladding at which it occurs. The ability to utilize copper thicknesses of a few mils which can be achieved by plating techniques rather than being required to use copper-clad steel could result in a large reduction in the cost of the cavity, since copper-clad steel sells for the same price per pound as pure copper.

Nelson reported on the problem of possible radio interference arising from the operation of Mark I. He said that the points from which RF radiation is likely to be significant are at the power lines, but that attenuations of the order of 10^8 should be attainable with proper filters. He said that the Mark I frequently falls in a band of frequencies assigned to fixed services. This band is from 11.975 to 12.330 megacycles. Transmitters operating in this band are located at Hong Kong, Shanghai, Pakistan, the Philippines, Alaska, and the United States. The Army has a transmitter at the Presidio at San Francisco which is assigned the frequency of 12.25 megacycles. The frequency of Mark I on the basis of the most recent model tests will be 12.26 ± 0.023 megacycles. The frequency assignments in the above-mentioned commercial band are 5 kilocycles apart, whereas our frequency uncertainty is $\pm$ 23 kilocycles. Alvarez said he thought an attenuation of the rf radiation by a factor of 10^8 would be very difficult to obtain in practice. Farly said that one bad source of radiation will probably be at by-pass condensers on the drift tube supporting stems and that these will require special shielding.

Brobeck said that some tests of rf conductivity have been run on samples of copper which will be used for the Mark I liner and a difference of 20% has been found depending upon whether the sample was chemically cleaned or sand blasted, the sand-blasted surface having the lower conductivity. These tests were run at 120 megacycles. The percentage loss in conductivity may be different at 12 mc but the conclusion is that sandblasting is undesirable.

Lofgren said that assembly of the full-scale injector has been completed, with the exception of the power supply which is expected to be completed on Saturday.

Martinelli said that the new focusing magnets to be installed in the electron accelerating model of Mark I are being assembled. Alvarez said that this next test with the electron model to verify the design of the Mark I focusing magnets is the last test scheduled to be run with this model.

The first drift tube magnet is being assembled at the West Berkeley warehouse. All of the coils are in place on the magnet and the end plates will be put on tomorrow. The magnet will be ready for electrical testing in about two weeks. Full-scale field tests will be run on these magnets in the Bevatron building when the generator power supply is ready. The components for the balance of the magnets are in production. With the exception of the end plates for the magnets all of the necessary parts are available and the limiting factor in

their completion is the number of cleared men available for the assembly operation. The first drift tube stem is being stress relieved today. The next step will be machining. Fabrication of the copper drift tube shells is nearing completion. The next stage is the application of cooling tubes and resistance heaters. Following this, the drift tube shells will be assembled around their respective magnets. It is expected that this latter assembly will be performed in the Bevatron building, which has now been closed off as an exclusion area with the exception of the power supply wing. Negotiations are now under way with the Oscar Krenz Company for adding the cooling tubes, resistance heaters, and for final assembly of the drift tube shells. Ninety percent of the detailed parts for the drift tubes are out for bid at the present time and none of the remaining items are expected to hold up assembly operations. Twitchell added that it is planned to have one oscillator ready in Building 52 by March 15. This is the same date by which tests will be possible with the B-1 cavity following the installation of the electrically heated high voltage sphere.

Hansen said that all steel is now in place for the accelerator building at Livermore, with the exception of the east end. Riveting should be completed by early next week. Most of the forms are in for the decking on the 17-foot level on the north side and the east part will be poured Thursday. They are also working on the deck on the 34-foot level on the north side. The North Kinney pump slab has been poured and the pump foundations will be poured Thursday. Setting of the Kinney pumps can begin the first of next week. Twenty of the Chapman valves have been set in place on the vessel and 5 or 6 of the diffusion pumps have been mounted. Manifolding for these units is being installed. All of the steel plates on the vessel are now in place and about 85% of them have been welded. The wing on the west end of the building is complete. About 80 of the 640 shielding blocks have been finished. The steel for the sub-station for the power distribution system is in place, together with the wood roof for this building. The disconnect racks at the end of the building are in place. The switch gear is now being set in place. The base plate for the large motor generator set for the No. 1 power supply is being installed. Ets-Hokin & Galvan, the contractor for installation of power supplies 1, 2, 3, and 4, was on the job the first of this week. The furnace which will be used for brazing cooling tubes to the liner sections has arrived at Krenz's shop and work with this equipment is scheduled to begin next week. Negotiations are proceeding to select an electrical contractor on a time and materials basis for classified assembly work which remains to be done.