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Monthly Progress Report for November, 1961

INVESTIGATION OF THE EFFECT OF ULTRA-RAPID QUENCHING
ON METALLIC SYSTEMS, INCLUDING BERYLLIUM ALLOYS

Prepared for
Commander
Wright Air Development Division
Wright-Patterson Air Force Base, Ohio
Attention: ASRCMP-1

Contract AF 33(616)-8011
Project No. 1(8-7351)
Task No. 73517

EOS Report 1650-M-8

15 December 1961

Prepared by

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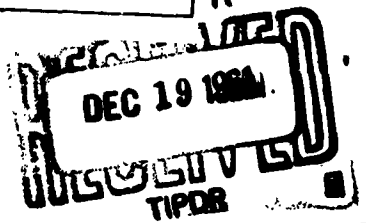
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Approved by

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ELECTRO-OPTICAL SYSTEMS, INC. - PASADENA, CALIFORNIA

This is the eighth monthly report on the subject contract, covering the month of November, 1961.

During the report period, no further changes were made in the existing apparatus. Construction of the new gun (as mentioned in the preceding monthly report) was begun, and is expected to be complete by the middle of December.

Reexamination of ^{examined} the Be-Si system was ~~continued~~ in an effort to clarify the question as to whether any degree of solid solution is produced by splat cooling. It will be recalled from previous reports that the lattice parameter of the Si appeared to be slightly reduced by quenching in alloys containing 40, 60, and 75 w/o Be, but not in an alloy containing 20 w/o Be. To check these results, the 20 w/o Be was repeated, but confirmed the original finding, as described in the report for October. During November, new ^{examined} alloys of composition 40, 60, and 75 w/o Be were prepared and quenched. The X-ray patterns of these alloys, both before and after quenching, showed no significant changes of spacings from those ~~given in the ASTM pattern~~ for pure Si, which in turn were very nearly equal to those measured from a pattern of pure Si made at Electro-Optical Systems. These conclusions were checked both by direct comparison of the films of the alloys against the film of pure Si, and by comparison of the spacings measured on the films of the alloys with those given in the ASTM pattern. It appears, therefore, that no change due to rapid quenching ^{occurs} ~~has been found~~ in the Be-Si system.

In the Be-Cu system, an additional composition (namely 40 w/o Be) representing the eutectic between Be and the ^{delta} phase was prepared and quenched. The reflections of Be and of the ^{delta} phase were identified on the X-ray patterns ~~both~~ before and after quenching, and no shift in the spacings of either was found.

Further effort was devoted to the problem of the $\text{Be}_{21}\text{Ni}_5$ pattern, discussed in the previous monthly report. An excellent powder pattern of this phase was obtained and measured to serve as a standard; it appears from this film that the pattern given in the ASTM Index is definitely in error because of the inclusion of extraneous reflections. Even with the clarification of the problem which has thus been achieved, a completely satisfactory interpretation of the patterns obtained in the study of the Be-Ni system has not yet been attained, and may not be possible within the scope of the contract.

It was previously found (see EOS Report 1650-4M-2) that the Be-Ni alloy containing 58 w/o Be exhibited (after rapid quenching) the powder pattern of a face-centered cubic lattice with parameter 4.05 Å. Spectrographic analysis has now showed that the principal constituent of this sample is aluminum, which explains the X-ray pattern obtained. Apparently the sample identification was confused with that of one of the Be-Al alloys.

Repeated efforts have been made to obtain beryllium hydride from various chemical supply firms without success. It was recently learned that a considerable effort was devoted to the synthesis of this compound at the Los Alamos Scientific Laboratory of the University of California, and that this attempt was also unsuccessful (see Los Alamos Report LA-1660, dated April 1, 1954). Since the use of such an intermediate phase offered the only possibility of studying the Be-H system within the scope of this contract, it appears that it will be impossible to carry out such a study.

During the month of December, which is the final month of the contract, the new gun will be completed and applied to the quenching of at least a few of the alloys already studied, in order to see whether the more rapid quenching produces any change in the results. Further effort will be devoted to clarification of the problem of interpretation in the Be-Ni system, and the final report for the contract will be prepared.