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CRITERIA FOR SUCCESSFUL COMPOSITE RESTORATIONS.(U)
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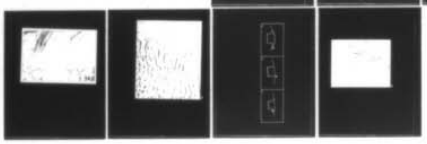

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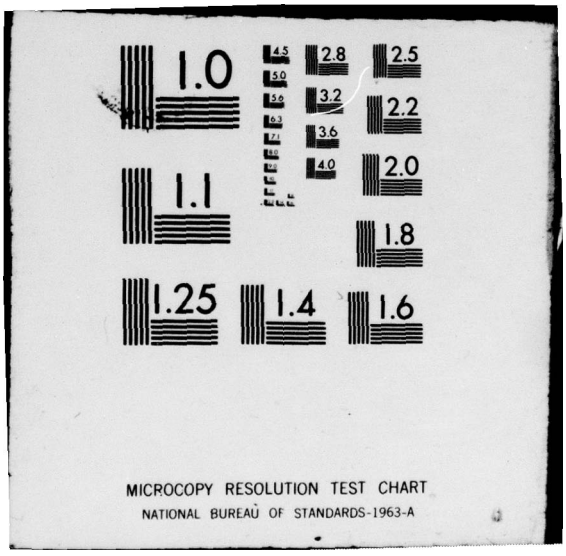
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Composite resin restorations, while not as manipulation-sensitive as some other restorative materials, must be handled correctly for maximum adaptation, and marginal seal. This article discusses criteria for cavity finishing, marginal form, etching, and dentin protection which are vital for success.

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CRITERIA FOR SUCCESSFUL

COMPOSITE RESTORATIONS

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Biographical Sketch

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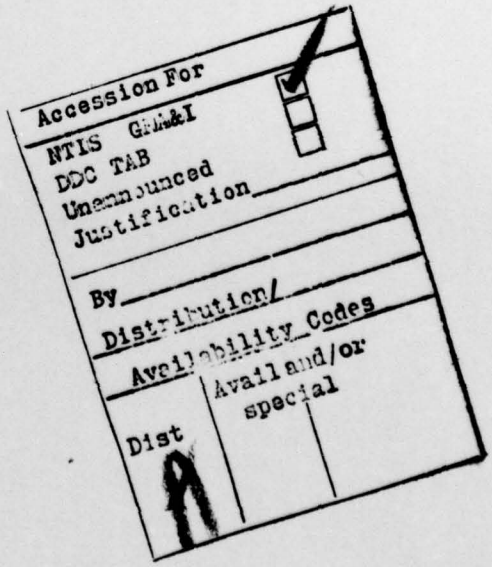

Synopsis

Composite resin restorations, while not as manipulation-sensitive as some other restorative materials, must be handled correctly for maximum adaptation, and marginal seal. This article discusses criteria for cavity finishing, marginal form, etching, and dentin protection which are vital for success.

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INTRODUCTION

Filled composite restorations developed their present enormous popularity because of certain distinct advantages which they enjoyed over the silicate cements. They are strong, can develop excellent micro-mechanical retention, are not as manipulation sensitive as silicate cements, and perhaps most important, are not as soluble in oral fluids as the silicates.

The filled composite resins do however lend themselves to misuse because of their ease of manipulation. There are certain critical areas in the preparation of the tooth surface that must be understood by the operator in order to create the finest possible composite restoration.

The dentist must prepare the tooth surface to receive the restorative material. This is not simply the mechanical process of removing decay, tooth structure or old restorations to provide a physical site for the restorative material but also the preparation of the tooth surface chemically for the best and most intimate contact with the restorative. The tooth surface must also be prepared to resist the irritant effects of the restorative materials. There are critical areas within the process of preparation that bear consideration: 1) use of water spray for mechanical preparation; 2) protection of the dentin; 3) etching of the tooth surface with acids; 4) choice of marginal form.

1) Use of Water Spray

Water spray, when preparing teeth with high speed rotating instruments, is a necessity. Water spray during mechanical preparation provides 3 distinct benefits.

a) debris is washed away from the cutting site.

b) the tooth structure is kept from heating up beyond biological acceptability.

c) the relatively delicate margins of enamel are cushioned against the shattering effects of bur chatter characteristic of enamel margins prepared without water spray (Fig. 1).

2) Protection of the Dentinal Surface

The dentinal surface, although it bears a superficial resemblance visually to enamel, is actually a living organ. The dentinal tubules contain protoplasmic processes which communicate with the pulp. These processes are easily injured by either the cavity cleaner or etchant, or by the irritating resin nonomers which make up the matrix of the filled composite restoratives (Fig. 2).

This dentinal surface should be protected by a layer of some type of calcium hydroxide base which serves as both a physical barrier against the influx of acid and as an acid neutralizer. If a dentinal surface is not protected during the acid etch procedure, placement of a composite restoration will result in composite tags extending deep (Fig. 3) into the dentinal tubules potentially leading to pulpal irritation.

3) Etching the Enamel Surface

The use of acid etching procedures for filled composite resins has been shown by several investigators to be a valuable, almost indispensable technique. Acid etch has two benefits:

(1) the tooth surface is cleaned of debris allowing a closer composite-tooth surface adaptation.

(2) there is selective etching of the enamel prisms creating areas for micro-mechanical retention.

It is the opinion of some authors that etching not only increases retention but reduces microleakage,[1,2] and that use of acid etching should

be considered as a routine part of the restorative procedures.

Considerations in Etching

a) Time of Etching: Teeth vary in their susceptibility to being etched. The desired objective is a well etched surface; this is evidenced visually by the even (Fig. 4) frosted appearance of a dry tooth. The tooth should be pumiced lightly prior to etching, it should then be isolated, dried, and the etchant applied. The tooth should be kept covered with etchant for one minute and then (it should be) washed, dried and inspected. In the majority of cases one minute etching will provide the desired frosty appearance. If not, the etchant should be reapplied for 30 seconds. Then the washing and drying should be done and the etched surface re-evaluated.

It is important not to over-etch. Over-etching produces a disorganized surface covered with precipitated insoluble calcium products leading to loss of mechanical retention.

b) Concentration of Acid: Most commercially available etchants are phosphoric acid in the 30-40 :/. concentration range. This has been shown to provide good depth and quality of etched surfaces.[3]

c) Washing & Drying: It is important to wash and dry the surface well. Washing removes the acid and residual debris, the drying removes moisture from the etched areas which would hinder the adaptation of the composite and its polymerization.

One should wash for 30 seconds with tap water and dry using oil-free dry air spray for 30 seconds per tooth to provide an adequate assurance that all residues of acid and moisture are removed.

4) Marginal Form

The ability of composite resins to be "bonded" mechanically to the etched enamel has lead to margin designs which encourage maximum enamel

coverage.

The designs which feature a feathered edge of composite have the advantage of maximum enamel contact but the disadvantage of being difficult to finish to a smooth even edge and being overcontoured (Fig. 5a). These designs are particularly inappropriate for Cl III restorations where overextension may be disastrous to the periodontium. A butt joint can be easily finished but has a minimum of etched enamel to which to adhere (Fig. 5b). In addition, due to the orientation of enamel rods, the etching at a butt joint may not provide a sufficient degree of micro-mechanical retention to take advantage of this important feature of composites. Beveled margins have been found to be more efficacious in preventing microleakage and the wider bevels (.5 - 1.00 mm) showed less incidence of enamel cracking adjacent to the margins then either butt joints or narrow bevels (Fig. 5c).[4] Bevels may provide access to the ends of enamel prisms for etching which may otherwise not be exposed by ordinary cavity preparation (Fig. 6).

It seems that bevelled margins combine the ability to be well finished with an increased area of enamel average and may therefore be the margin of choice.

SUMMARY: The success of composite restorations hinges on the ability of the operator to maximize the assets of this restorative material and avoid critical pitfalls in technique. Critical areas covered are cavity preparation, dentinal protection, etching techniques, and choice of marginal form. The choice of method should be based on information rather than convenience.

BIBLIOGRAPHY

1. Galan, J.; Mondelli, J.; and Corodazzi, J.L. Marginal leakage of two composite restorative systems. J. Dent. Res. 55:74, 1976.

2. Hembree, J.H. and Andrews, J.J. Microleakage of several acid etch composite resin systems: a laboratory study. Operative Dentistry 1:71, 1976.

3. Beech, Derrich R. Adhesion and adhesives in the oral environment. Ann. R.A.C.D.S. 5:128, 1977.

4. Øilo, G. and Jorgensen, K.D. Effect of Bevelling on the occurrence of fractures in the enamel surrounding composite resin fillings. J. Oral Rehab. 4:305, 1977.

Figures 2 & 4 are reproduced through the courtesy of Dr. I. E. Barnes, Royal Dental Hospital of London, Dr. Alan Boyde of University College, London and the Editor of the British Dental Journal.

The photographic reproductions of the SEM pictures were done by Mr. W. Gray, Biophysic Department, Division of Oral Biology, US Army Institute of Dental Research.

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The opinions expressed herein are those of the authors and are not to be construed as those of the Army Medical Department.

LEGENDS

Figure 1 Cavosurface angle of enamel shattered when the cavity preparation is done without water spray. Scanning electron micrograph (SEM) original magnification 350 times.

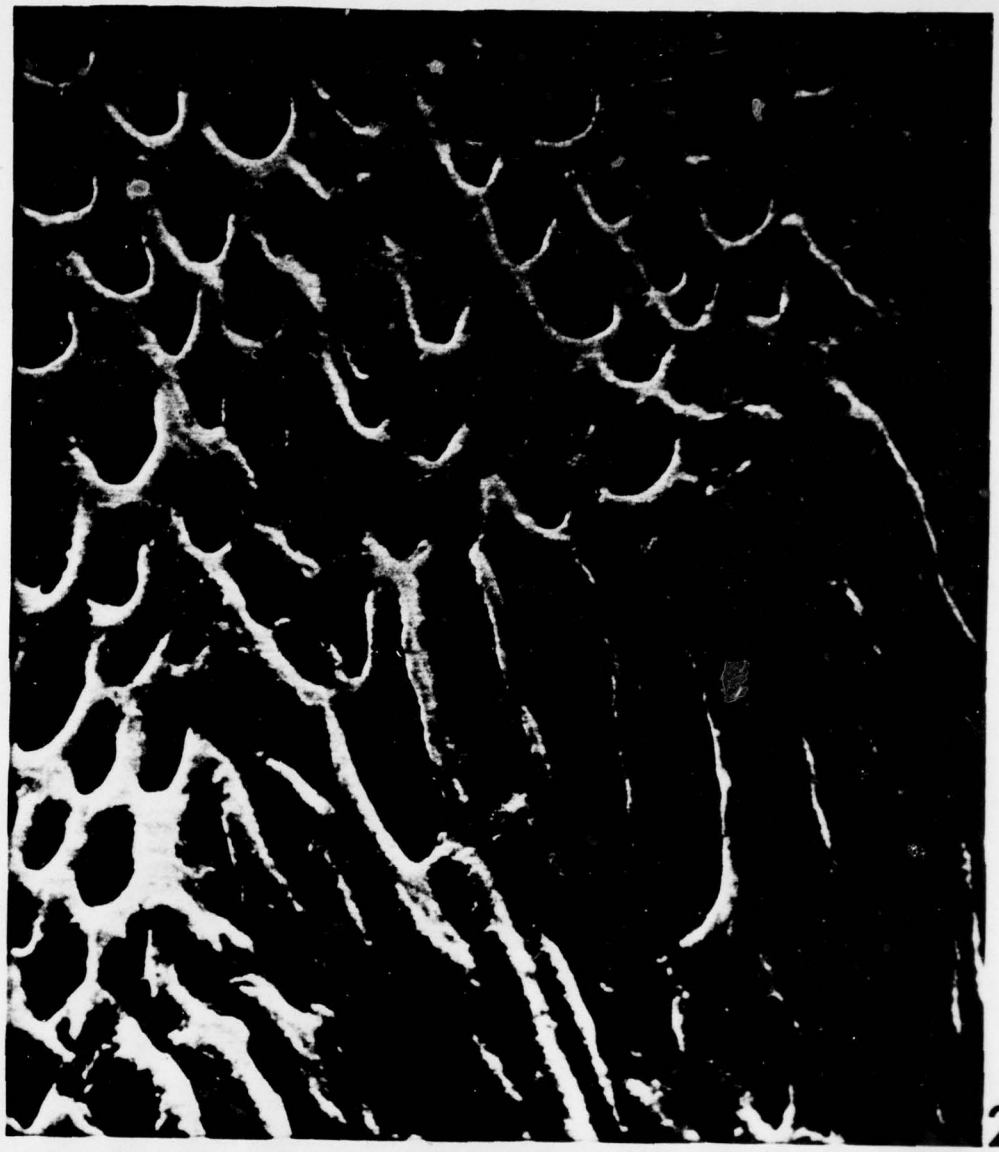
Figure 2 SEM of dentin which has been "cleaned" by cavity etchant. Protoplasmic processes have been destroyed. Original magnification 660 times.

Figure 3 SEM of sealant tags forced into open and unprotected dentinal tubules. Original magnification 850 times.

Figure 4 SEM view of well etched enamel. Original magnification 600 times.

Figure 5 Cavosurface margin designs (a) overextension, (b) butt joint and (c) bevelled.

Figure 6 SEM of composite tags appearing on a bevel which crossed plane of enamel rods. Original magnification 850 times.



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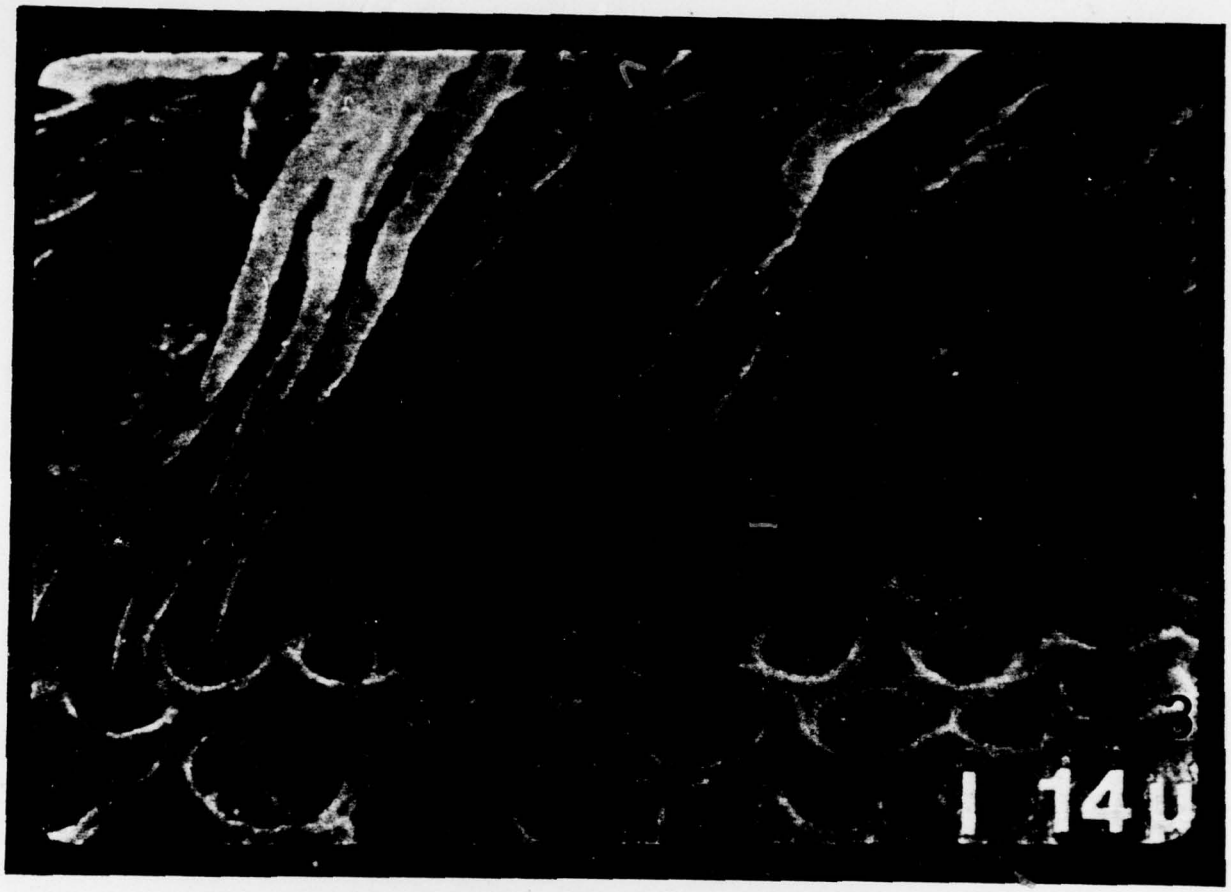
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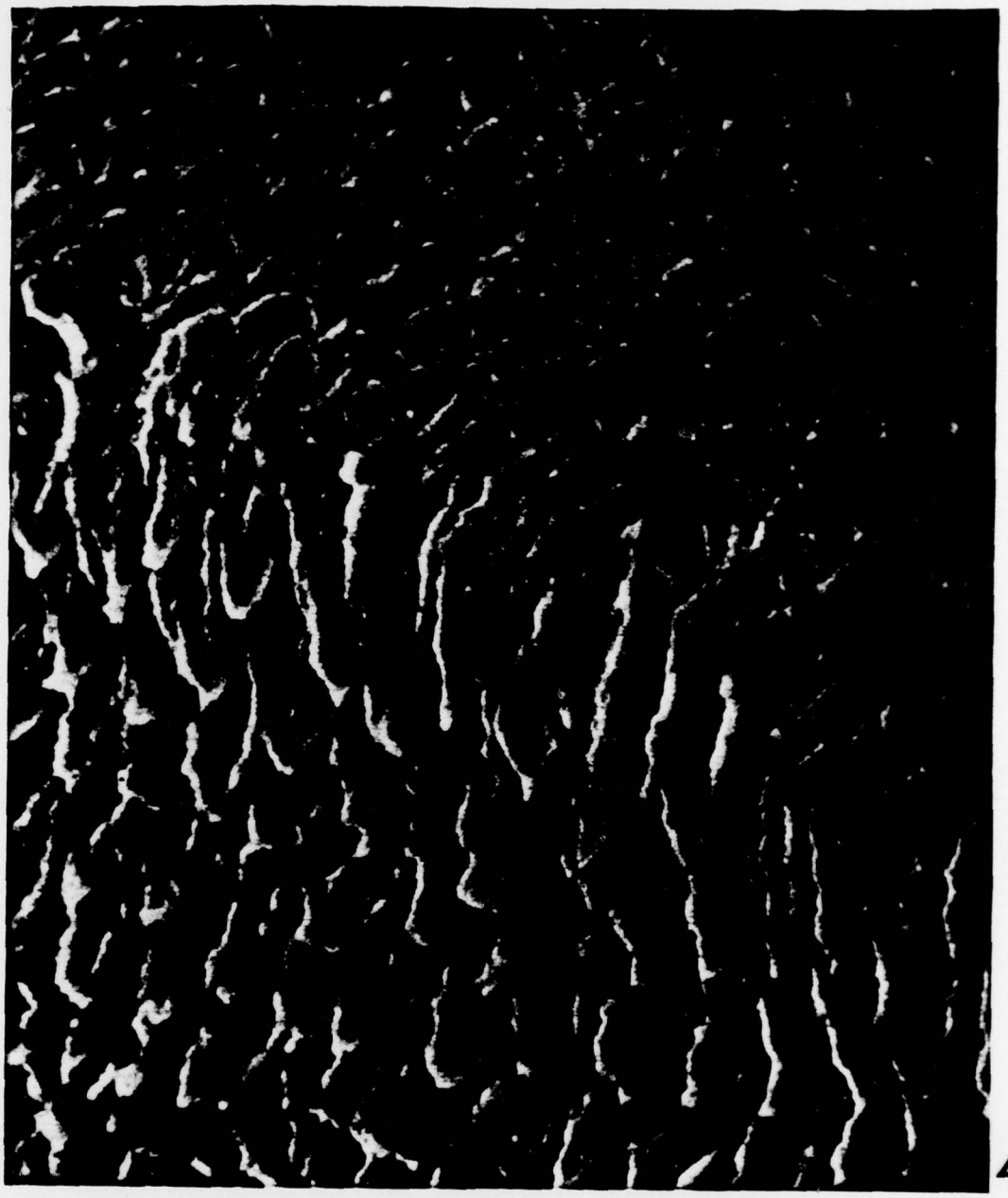

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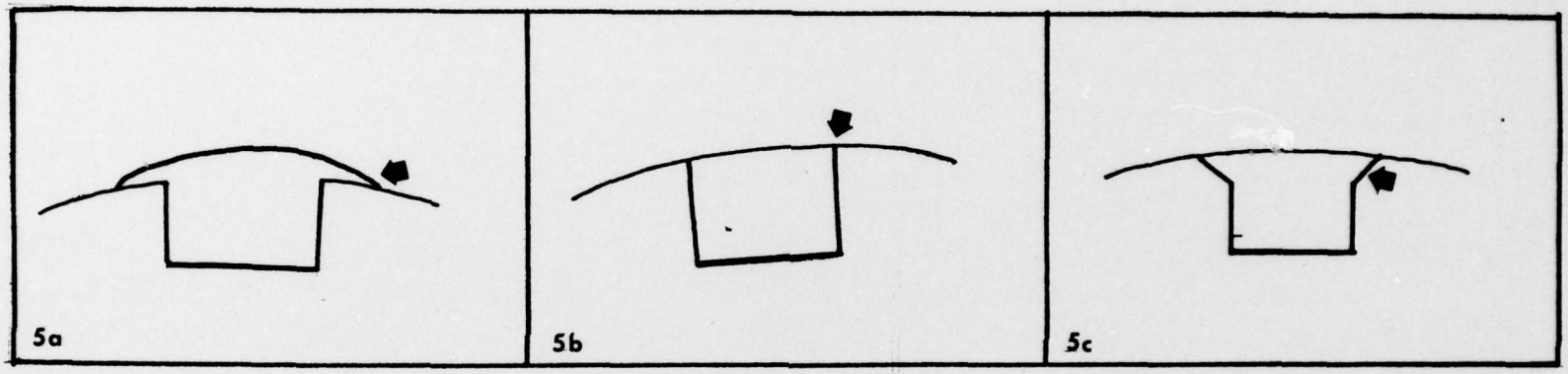
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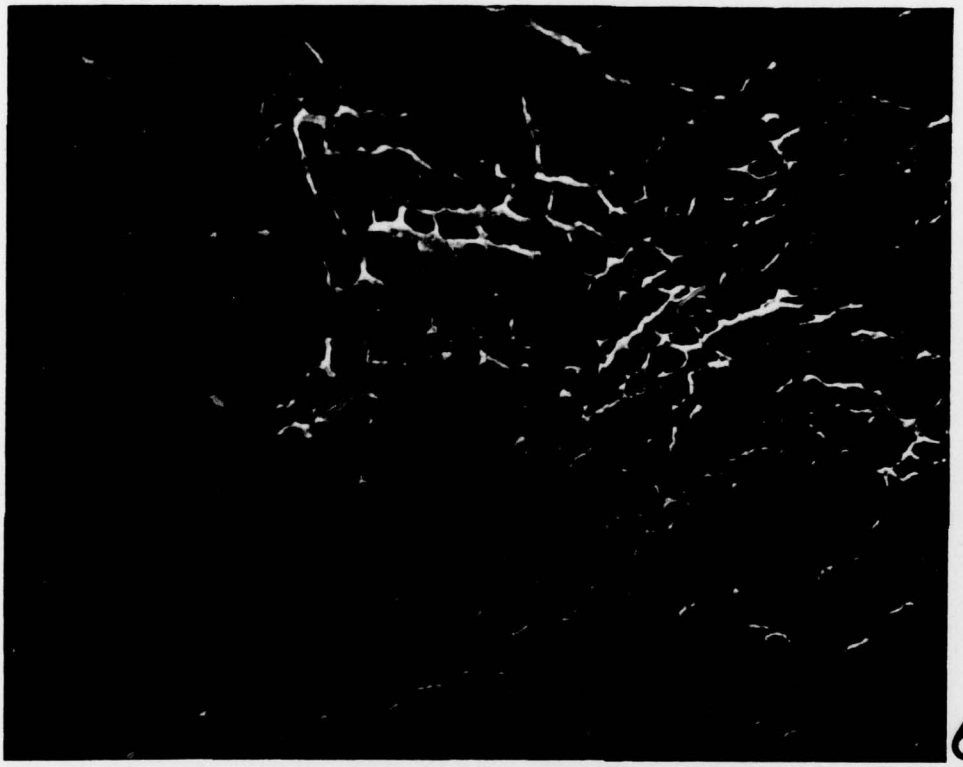

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