HIGH TEMPERATURE STRAIN GAGES

By: Anthony Cross, StrainSense Limited

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HIGH TEMPERATURE STRAIN GAGES

500°F and above - up to 2600°F

TYPES INCLUDE:

- Resistance (ΔOHMS/ΔStrain)
- Capacitive (Δpf/ΔStrain)
- Fiber Optic (Δ Light/ΔStrain)

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HIGH TEMPERATURE STRAIN GAGES

NICHROME

- Dynamic Applications
- Useable to 950°C – Do Not Exceed!
- G.F. Very Stable With Temperature
- G.F. Very Stable With Handling
- Rugged And Durable

MOLECULOY®

- Dynamic Applications
- Useable to 950°C – Longer Life
- G.F. Unstable Unless Stress Relieved
- G.F. Unstable Unless Annealed

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HIGH TEMPERATURE STRAIN GAGES

PLATINUM TUNGSTEN

- Dynamic Applications
- Useable To 1200°C
- Double The Gage Factor
- Very High Resistance Change With Temperature
- High Elongation
- Static (special cases) to 480°C

HOSKINS 875 (KATHAL A1)

- Static Applications
- Useable To 950°C
- Must Be Used In Half-Bridge Configurations

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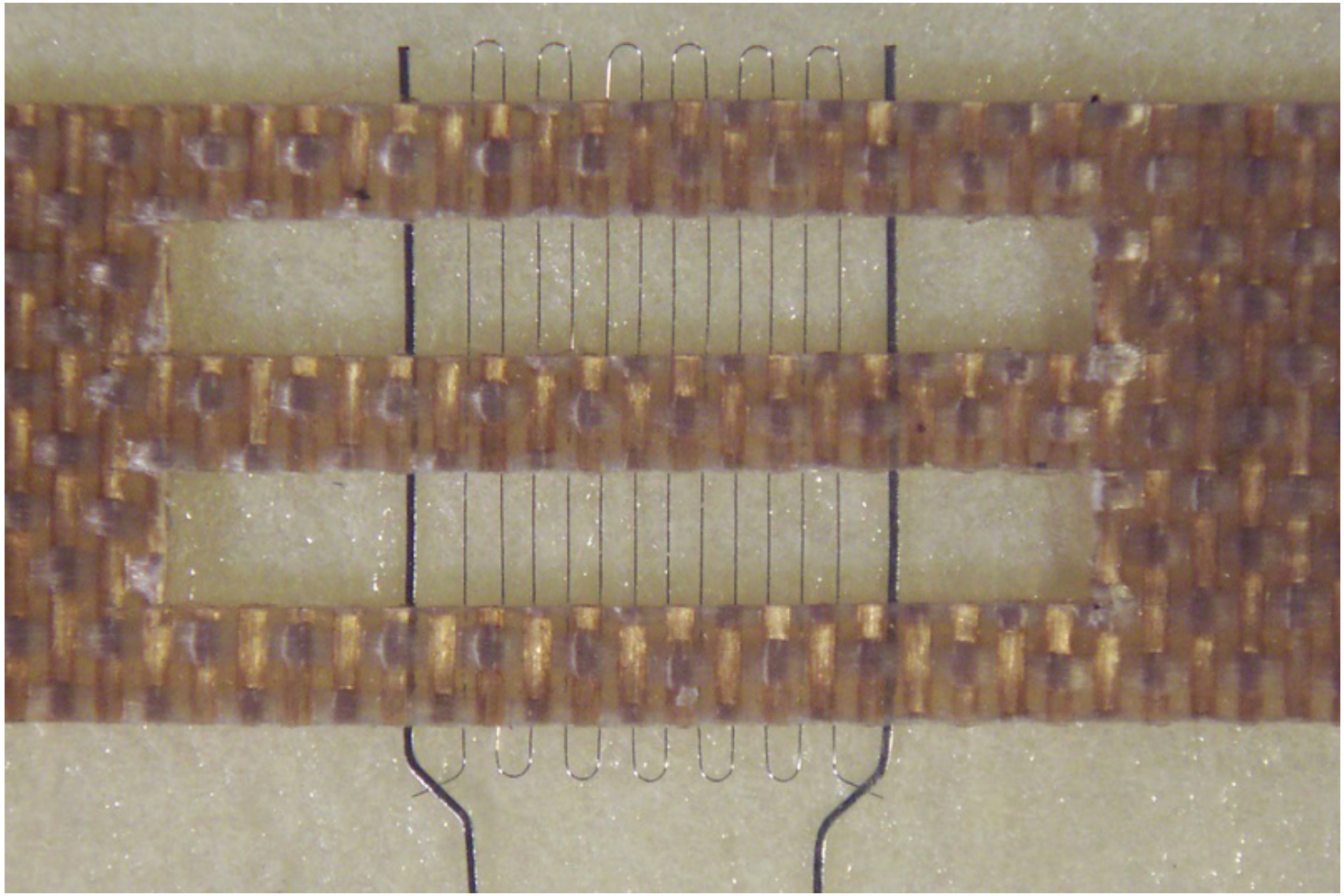

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OTHER TYPES

EVANOHM

- Dynamic Applications
- Useable to 950°C
- Similar To Moleculoy
- Static to 350°C

CAPACITIVE GAGE

- Static Applications
- High Strain Range
- Very Stable
- Bulky In Nature

FIBER OPTIC

- Working Models Demonstrated
- Easy to install

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DESIGN IMPROVEMENTS

LEAD WIRE JOINT DESIGN

STRAIGHT LEADS

- 1 TO 3 Million Cycles To Failure
- ± 700 Micro Strain Range
- Easy To Handle

"Z" LEADS

- + 10 Million Cycles To Failure
- ± 1000 Micro Strain Range
- Handling Is Different

INBOARD LEADS

- Used When Space Dictates
- Similar Life To Straight Leads

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DESIGN IMPROVEMENTS (CONT.)

TRUE FREE FILAMENT STRAIN GAGE

- Not Flattened – Round Wire For Best Life And Range
- No Tape – Long Shelf Life
- Easy Installation
- Relatively Expensive

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OTHER IMPROVEMENTS (CONT.)

INSTALLMENT TECHNIQUES

- Shading Bars On Tapes
- Vortex Cooler To Improve Installation Stresses

NEW CEMENTS

- Non Carcinogen Cement
- Silicon Carbide Cement – *no longer available*
- Pt Alloy Cements
- Ni Alloy Cements

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ATTACHMENT TECHNIQUES

CERAMIC CEMENT

- Many Types Available For Varied Applications
- Oven Curing Of Finish Installation Required

ROKIDE

- Equipment Costs Are High
- Wear Resistance And Durability Can't Be Beaten
- Line Of Sight Installation

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ATTACHMENT TECHNIQUES (CONT.)

SPUTTERING

- Expensive per Gage
- Large Parts Require Special Size Equipment

WELDABLE

- Easy To Install
- Lab Conditions For Installation Can Be 100% Quality Checked
- Many Applications Cannot Be Welded Due To Weld Deterioration Of Material Or Non-Weldability Of Specimen

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LEAD WIRES

- Conductor Choice
  - *Resistance per Length*
  - *Delta Ohms Over Temperature Range*
  - *Temperature Range of Conductor*
  - *Strength of Material*
- Insulator Choice
  - *Upper Temperature Range*
  - *G-Forces, Mechanical Environment*
  - *Temperature Coefficient Of Resistance*
  - *OHMS/Lead Length*

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CAPACITIVE GAGES

- Ultra, Ultra Stable, 20 Years Or Longer
- Very High Temperature, 1500°F, 2000°F
- Cannot Be Used In H_2O Environment, G-Force Or Dynamic Applications
- Special Instrumentation And Cables
- 1/2 Bridges Can Be Made Very Linear With Regard To $\Delta C/\Delta\mu\varepsilon$
- 1/4 Bridges Are Not Linear And Must Be Corrected Electrically

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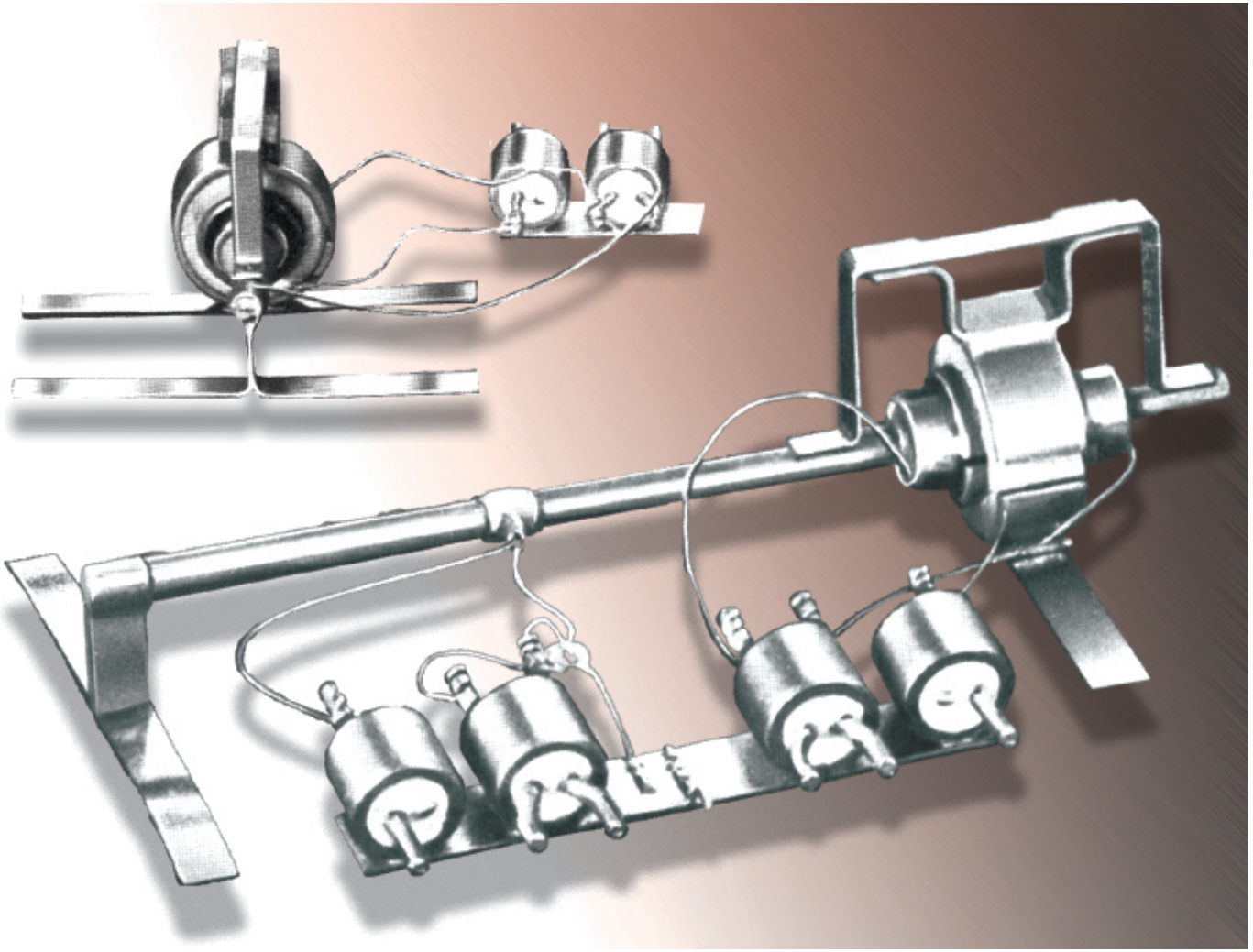

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FIBER OPTIC

- Tested to 600°C
- Small Sensor and Fiber Size
- Expensive
- Immune To Electric Noise
- Becoming a Practical Solution in Many Applications

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STATIC MEASUREMENTS

- Hoskins 875 Alloy In Half-Bridge NASA Langley Design Up To 1500°F. Attention Is Needed For Good Data
- Evanohm (known as Karma) to 350°C
- Platinum Tungsten TC Corrected to 450°C
- Palladium Chrome And Pt Alloys Also Used With Some Success
- Half Or Full Bridge Weldable Configuration Capacitive
- Optical Methods

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CURRENT DEVELOPMENTS

- **ITO** Refer to Dr. Otto Gregory's presentations

- **COATED NICHROME** Nano-coatings to prevent oxidation

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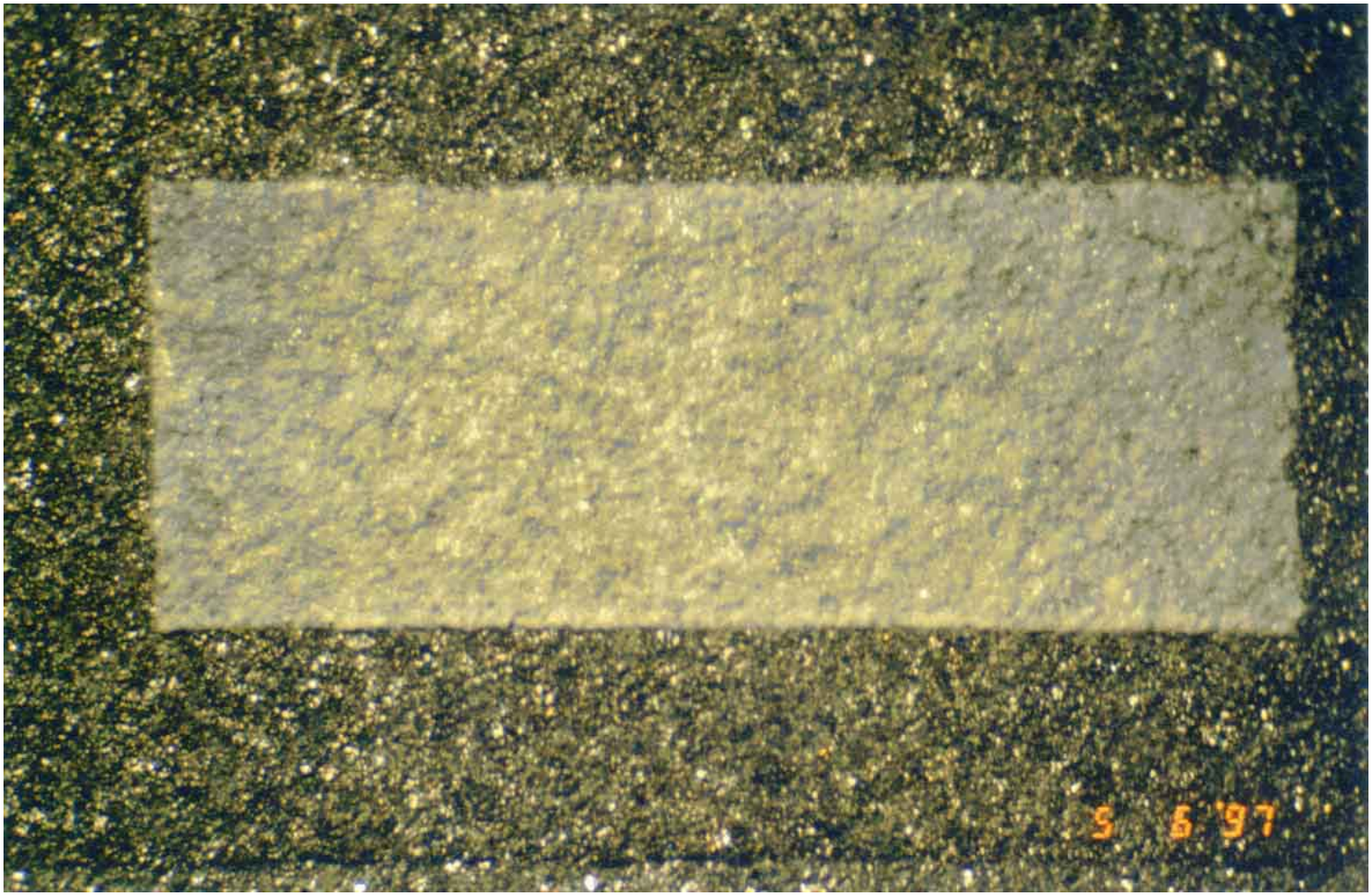

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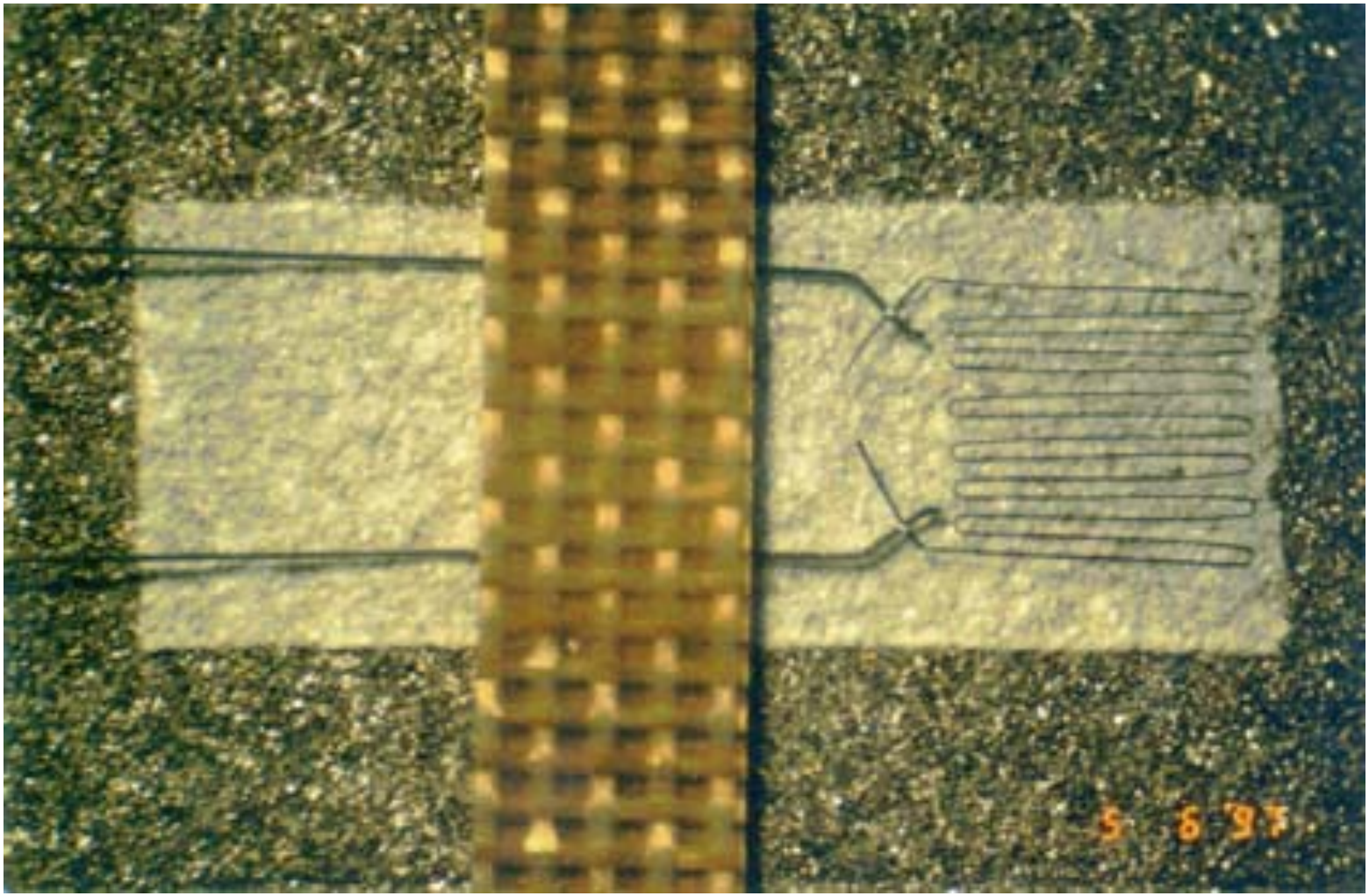

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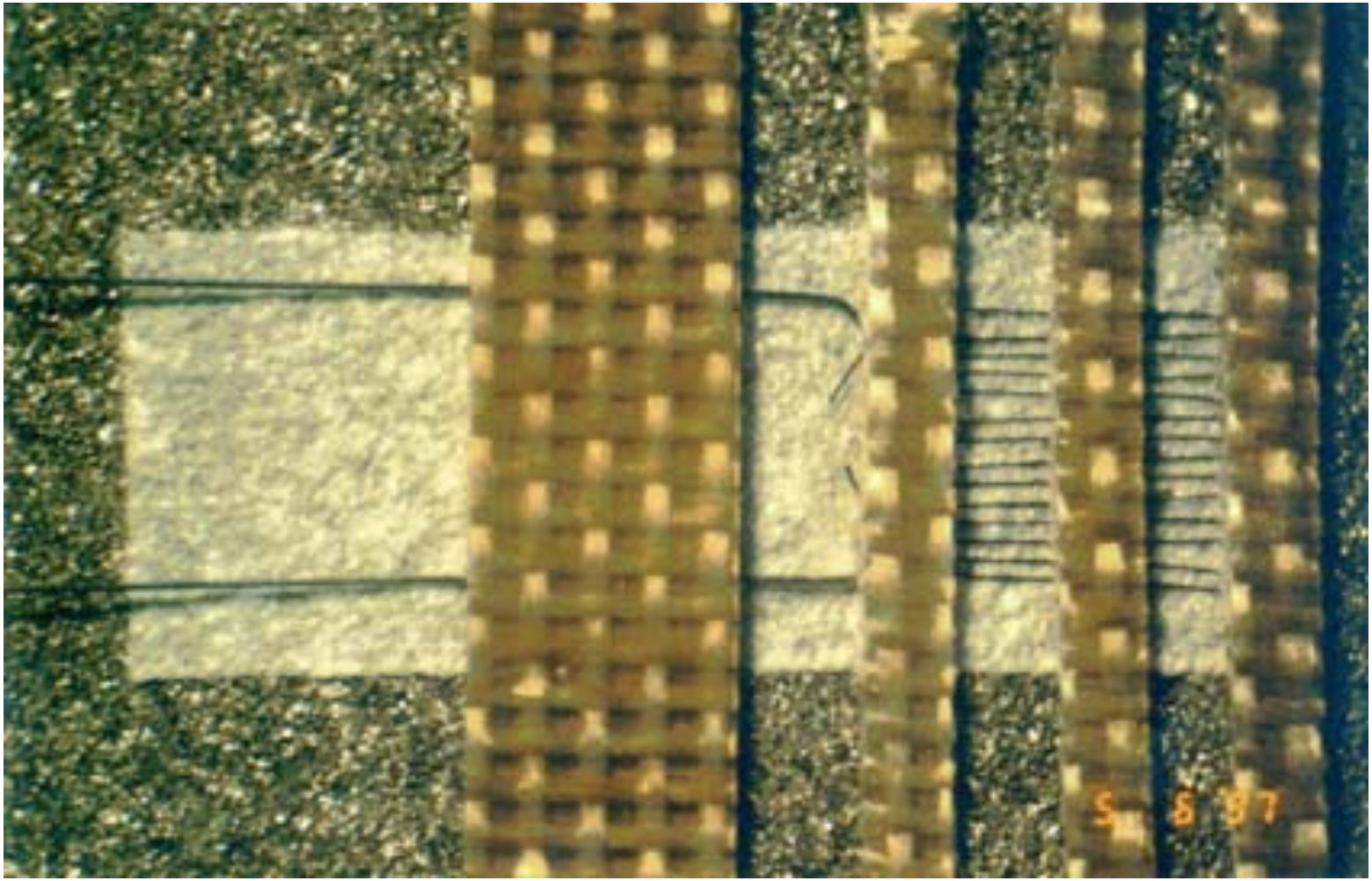

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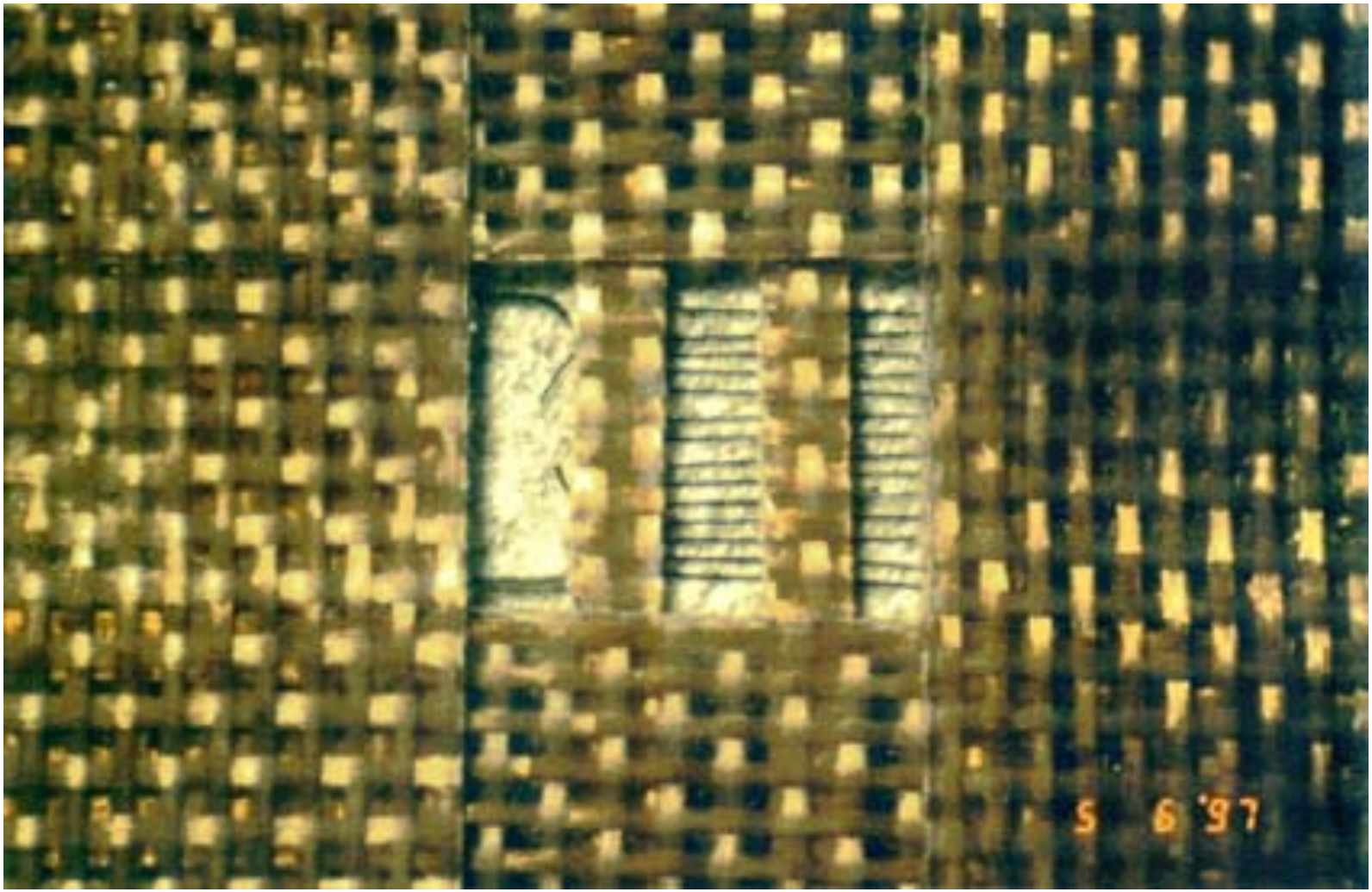

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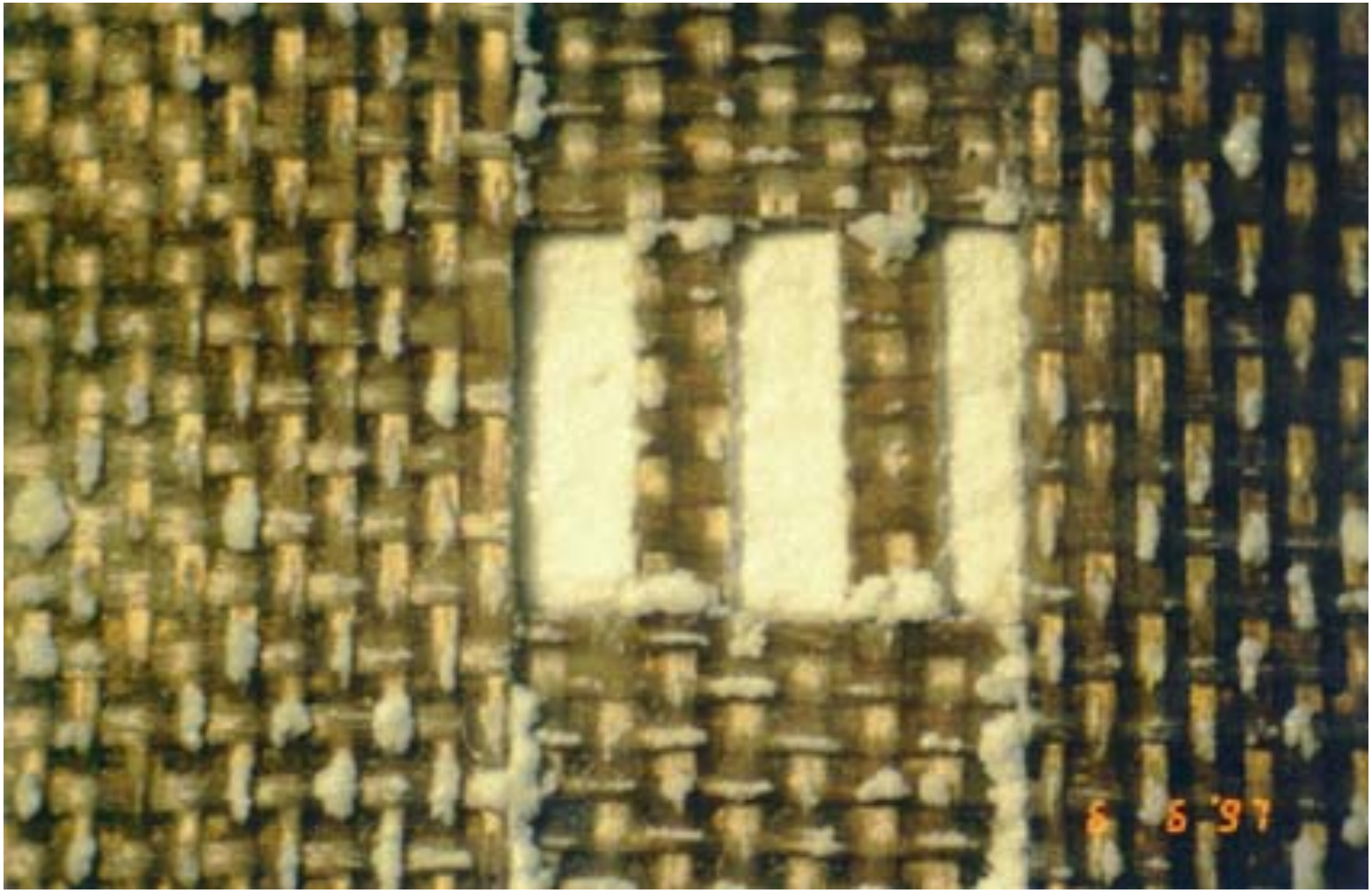

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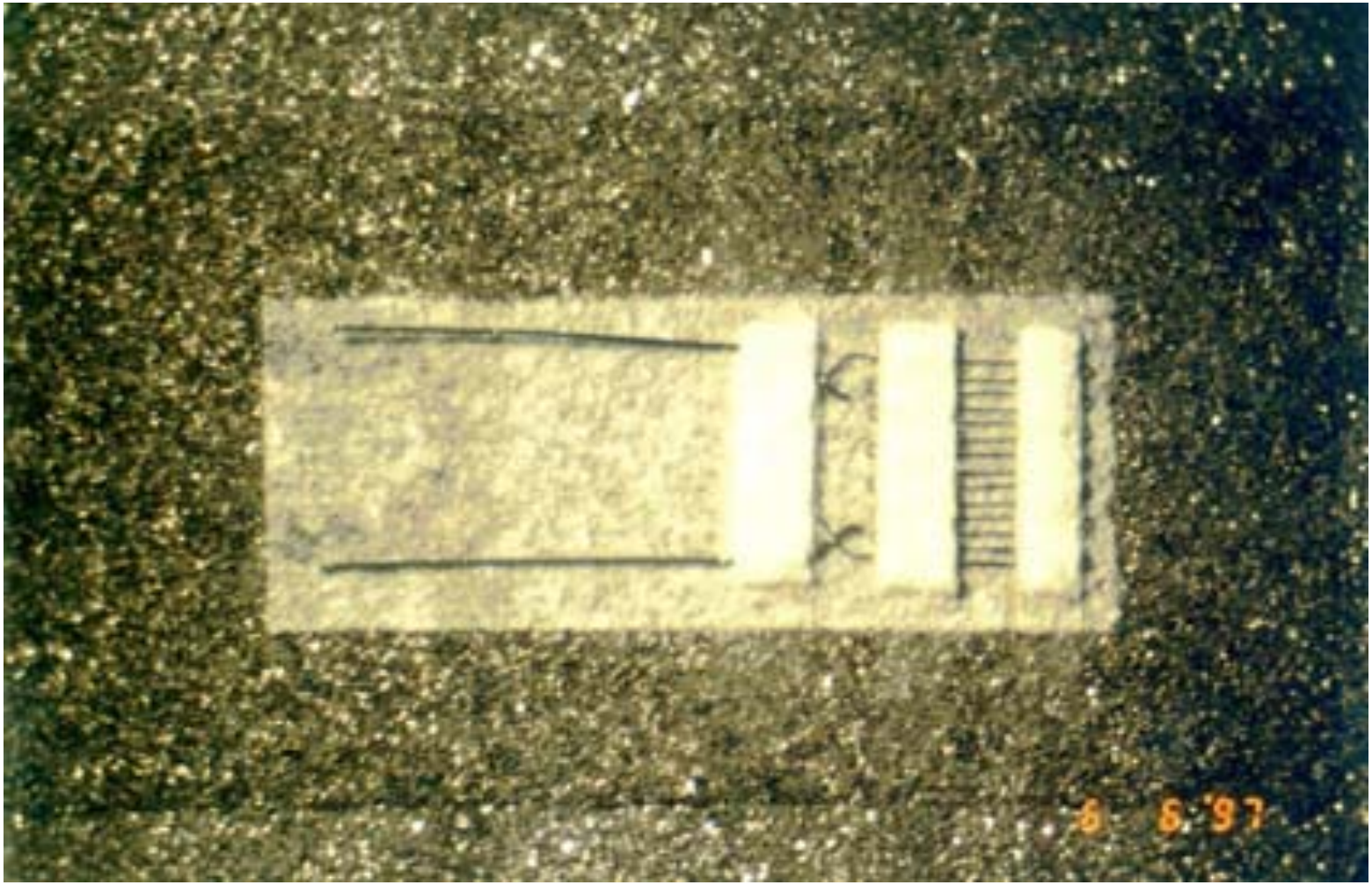

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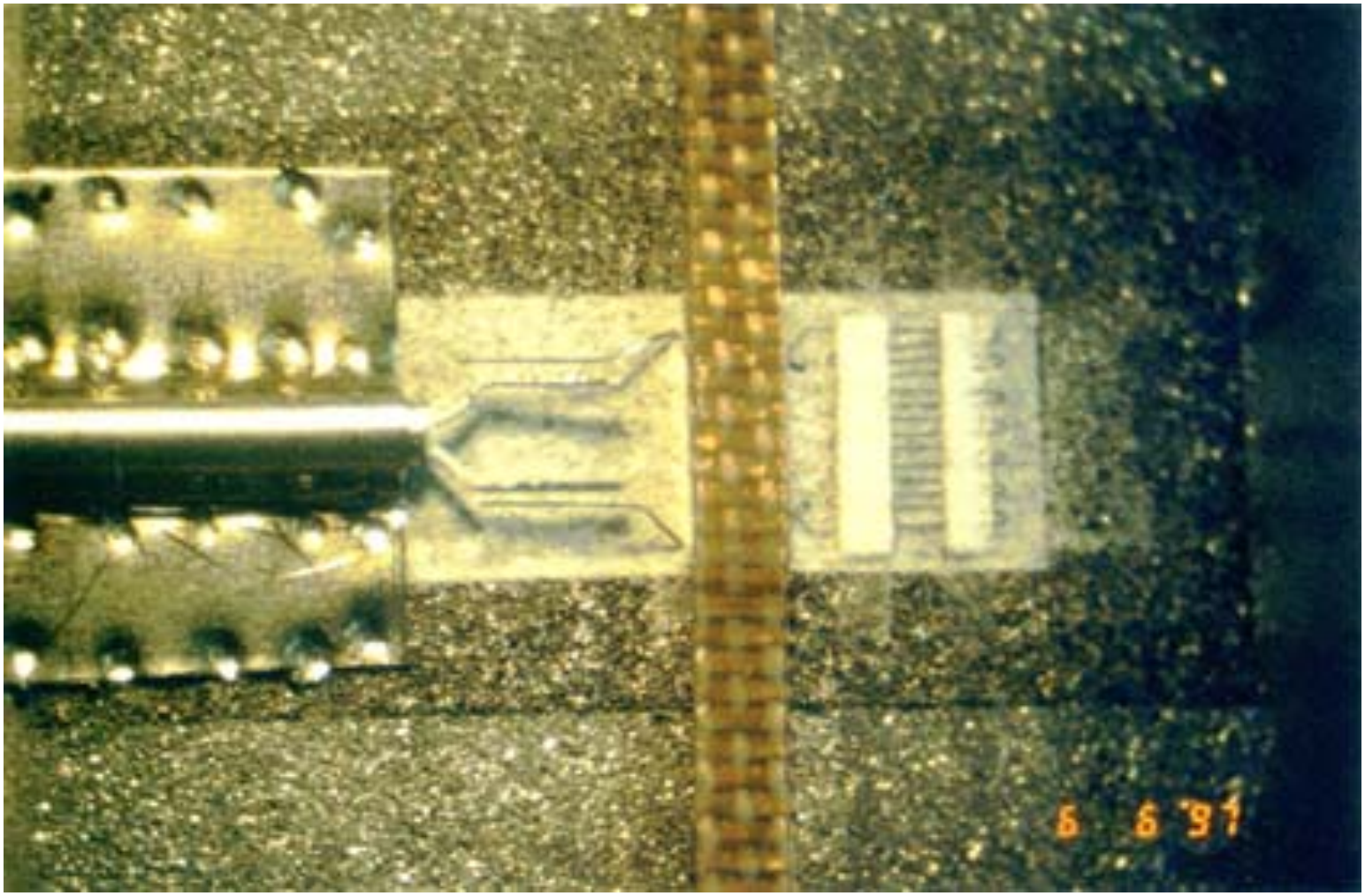

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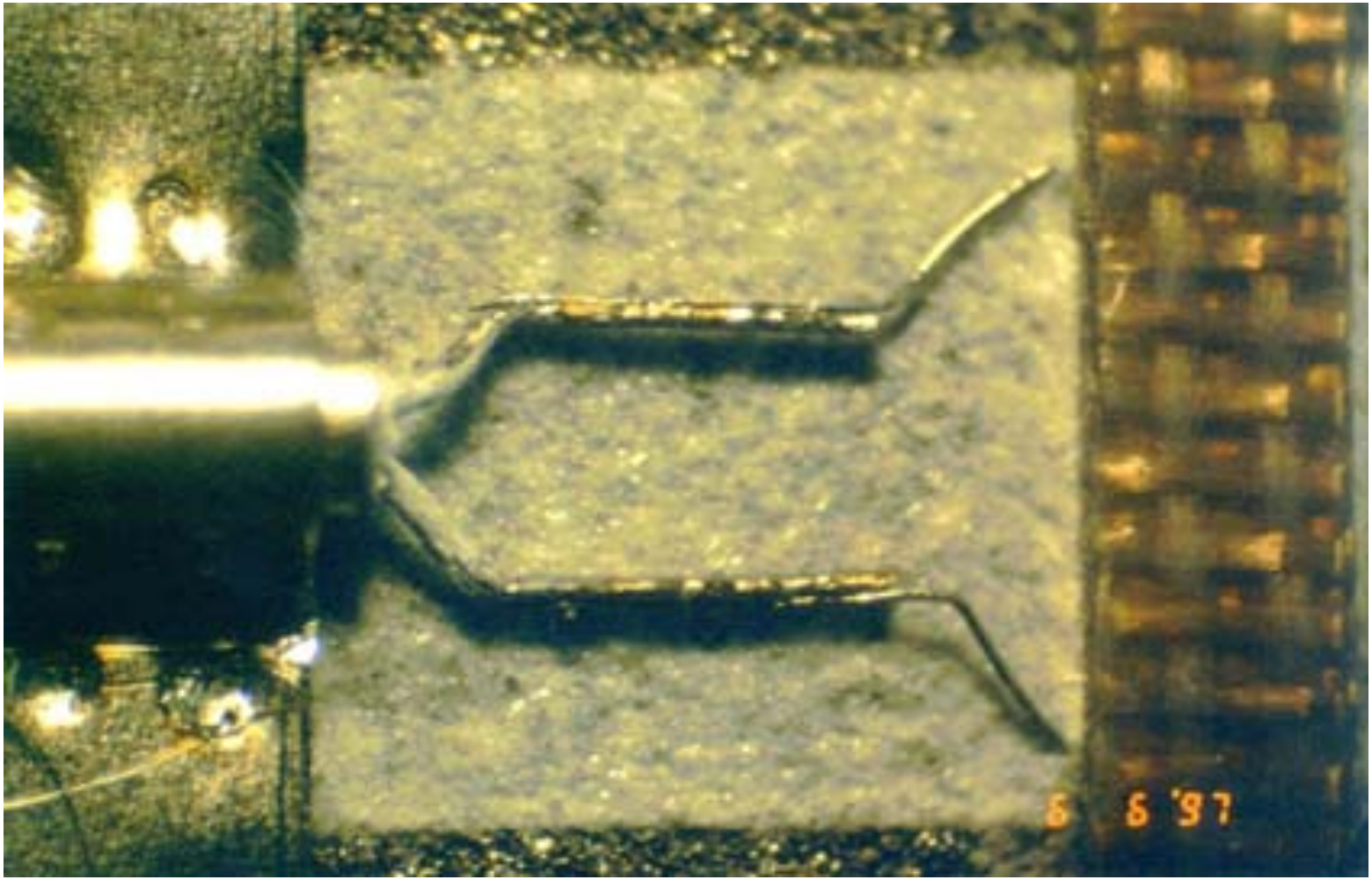

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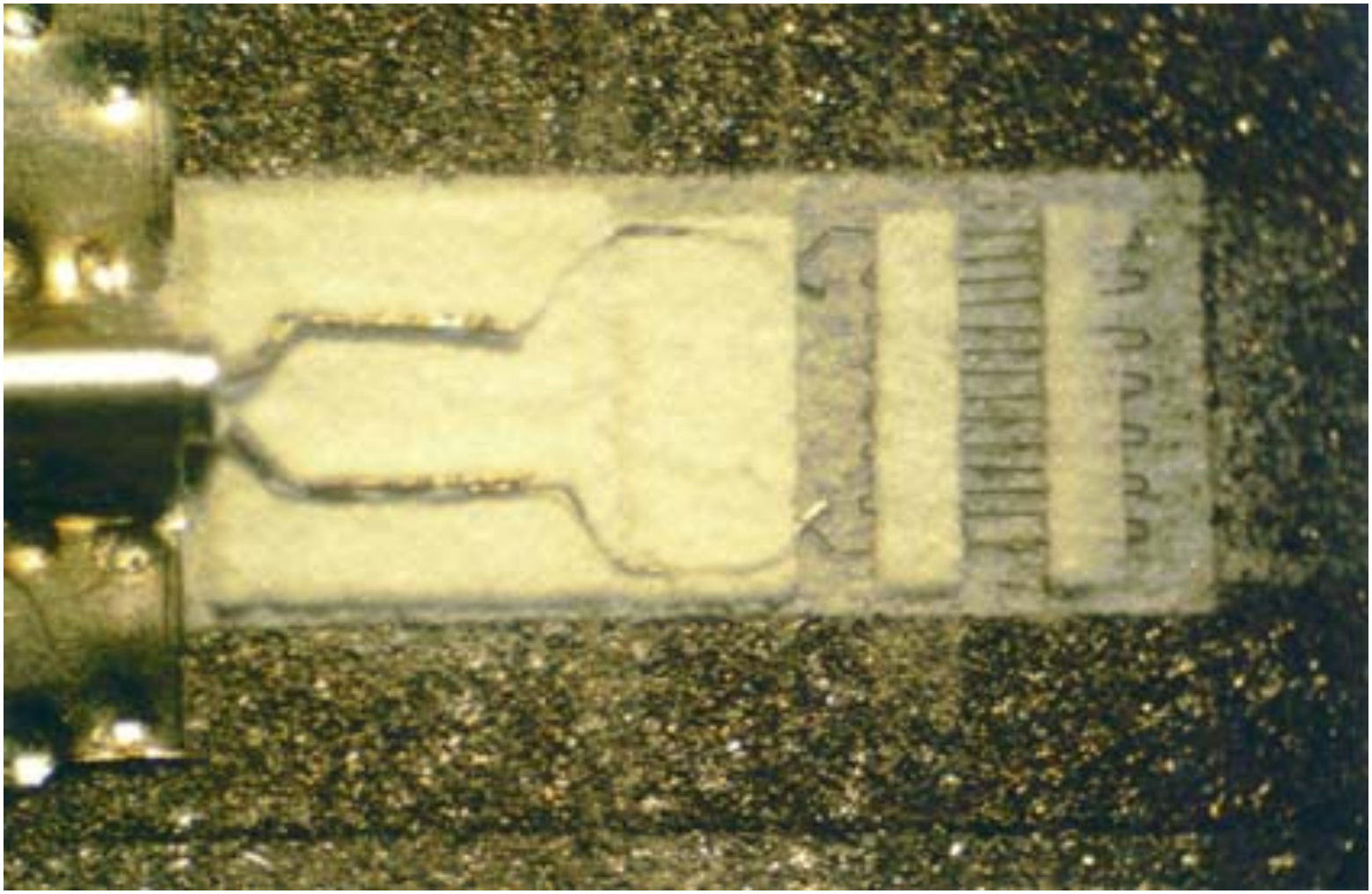

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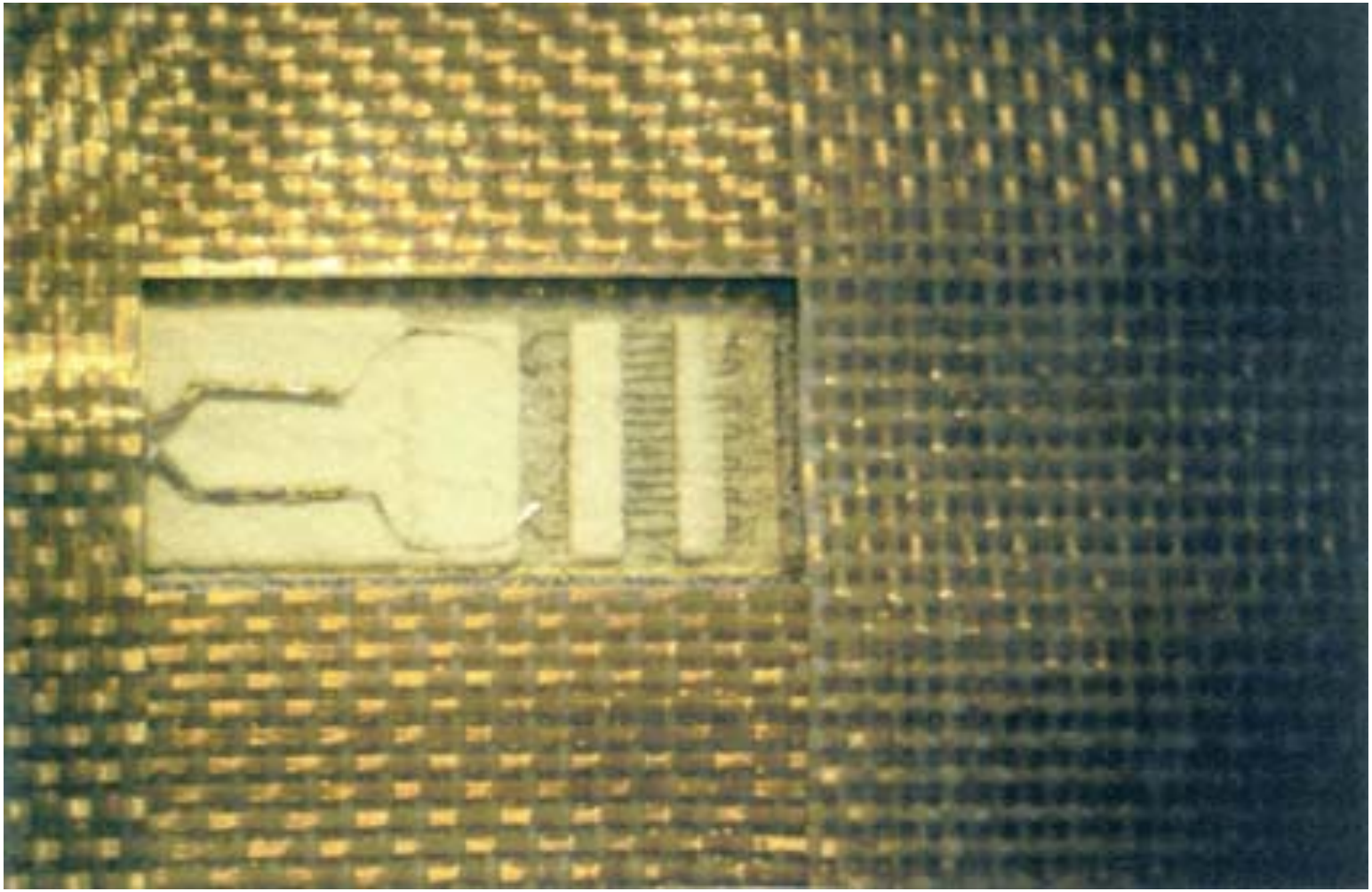

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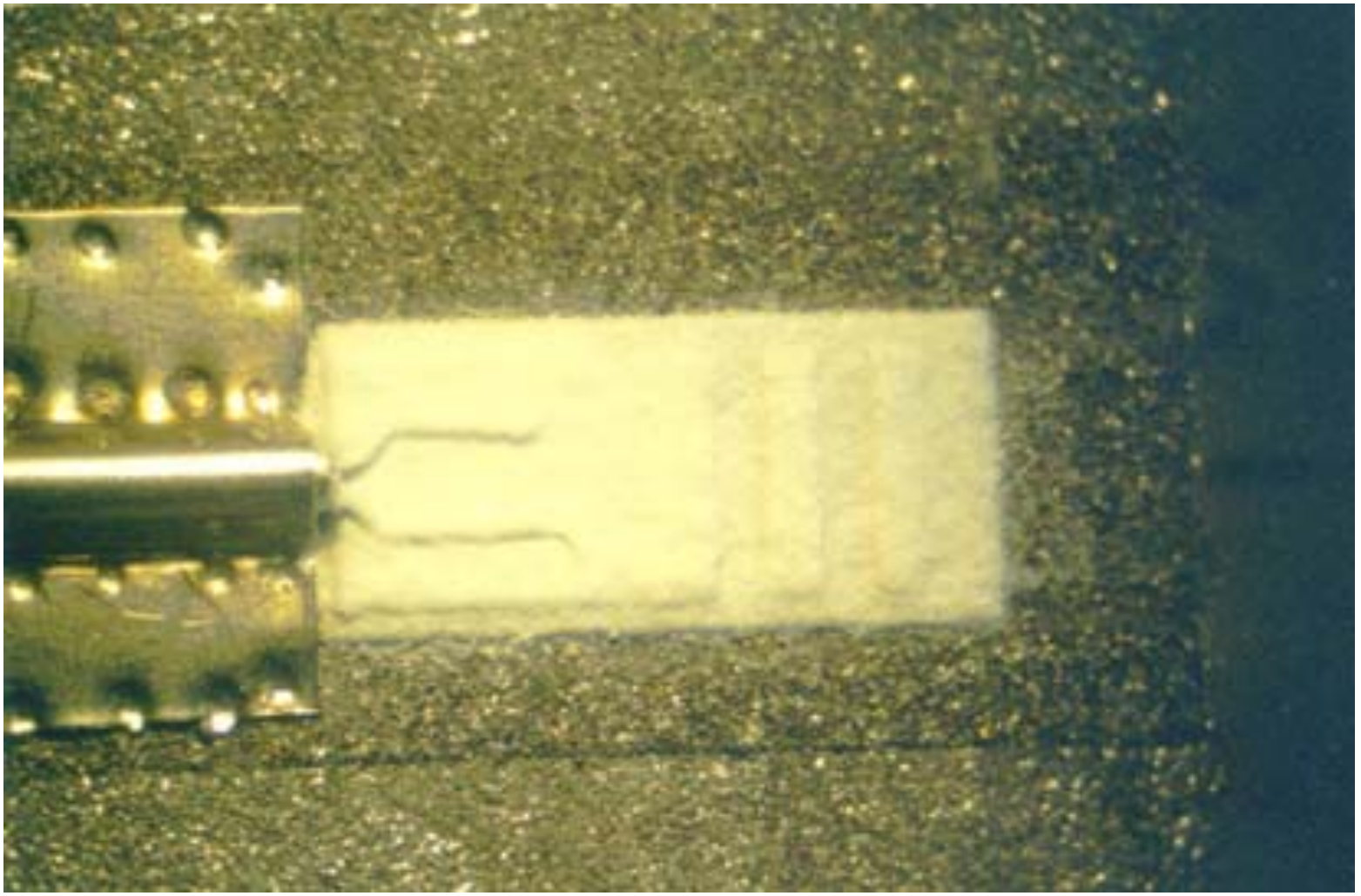

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