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NASA MATERIALS SCIENCE DIVISION REPORT
(23 pages)

NASA
DIRECTOR OF LOGISTICS OPERATIONS
MATERIALS SCIENCE DIVISION
MATERIALS AND CHEMICAL ANALYSIS BRANCH
LO-MSD-1C
KENNEDY SPACE CENTER, FLORIDA 32899

June 24, 1997

REPORT 97-1C0154

SUBJECT: Seat Samples and An Adhesive Reference Material Submitted by the National Transportation Safety Board (NTSB) During the Investigation of TWA #800.

REQUESTER. Dr. Merritt M. Birky/NTSB/(202) 314-6503

RELATED DOCUMENTATION: Report 97-1C0063
Report 97-1C0064
Report 97-1C0089
Report 97-1C0090
Report 97-1C0153

INVESTIGATOR: C. W. Bassett/LO-MSD-1C

CONTRIBUTORS: Stephen Huff/LO-MSD-2E
Kurt Leucht/LO-MSD-2E

1.0 FOREWORD

Samples of seat backing materials were submitted by the NTSB for the on-going investigation of TWA's flight #800 accident. The objective of the analysis was to characterize the reddish/brown material present on each of the samples. During the course of the investigation, the results were verbally communicated to the requester as they developed.

2.0 SAMPLE DESCRIPTION

The samples were contained in four sealed plastic bags labeled: #67, Row 19, Seat 2; #70, Row 17, seat 8; #73, Row 27, seat 2 and #74, Row 24, seat 7. The samples were collected from the seating area near the center of the aircraft. The 3M product Scotch-Grip™ 1357 High Performance (HP) Contact Adhesive was submitted by the NTSB as a reference material. The material safety data sheet (MSDS) identified the adhesive as a polychloroprene based product containing various hydrocarbon solvents.

3.0 CHEMICAL ANALYSIS

3.1 The analysis was accomplished using Fourier-Transform Infrared (FTIR) microscope spectroscopy.

3.2 Sample #67, Row 19, Seat 2 appeared to be a foam material. A red material was present on both sides with one side more heavily coated than the other (Figure 1). FTIR spectra for the foam material and the red material were independently generated and analyzed. The spectrum for each is provided at Figures 2, 3 and 4 respectively. The spectrum for the 3M reference adhesive (Figure 4) was compared to the spectra of the red material. The spectra for the comparison of the red material to the reference product is provided as Figure 6.

3.3 Sample #70, Row 17, Seat 8 (Figure 7) appeared to be a plastic or vinyl material with some of the unknown red material on one side. For the purposes of this discussion, the side which contained none of the suspected adhesive material will be referred to as the clean or non-contaminated side and the side which did contain some of the suspected adhesive material will be referred to as the contaminated side. FTIR spectra was generated for the clean side and for the contaminated side, the spectra of which are provided as Figure 8 and Figure 9 respectively. The spectrum of the reference adhesive was compared to the spectrum of the unknown red material. The spectral comparison is provided in Figure 10 and a spectral overlay in Figure 11.

3.4 The plastic or vinyl material from sample #73, Row 27, Seat 2 (Figure 12) was contorted much like the deformation which occurs when exposed to heat, whereas the material of sample #70 was smooth and exhibited no such altered conformation. Additionally, the unknown material which was attached to one side of sample #73 was tan or reddish-brown, whereas the contaminated side of sample #70 was red. The spectrum for the clean side of sample #73 is provided in Figure 13 and the spectrum for the contaminated side of the sample is provided in Figure 14. A spectral comparison of the reference adhesive and the red-brown material is provided in Figure 15 and a spectral overlay in Figure 16.

3.5 Sample #74, Row 24, Seat 7 (Figure 17) appeared to be a metal alloy (probably aluminum) and was characterized by charred material on both sides. Material from each side was removed and FTIR spectra generated. For the purposes of this discussion, the terms "darker side" and "lighter side" will be used to differentiate between the two sides. A gold colored glazed and a black organic appearing material were removed from the darker side and spectra generated. The FTIR spectra for each is provided in Figure 18 and Figure 19 respectively. From the lighter side, a "soot" looking material was extracted with an organic solvent and a spectrum generated. The spectrum is provided in Figure 20.

4.0 RESULTS AND CONCLUSIONS

4.1 Each IR spectrum of the seating materials (furnished as samples #67, 70 and 73) is consistent with the IR spectrum of the 3M polychloroprene reference contact adhesive. At no time during the analyses of these samples however, was there conclusive evidence to suggest that the Scotch-Grip™ 1357 High Performance (HP) contact adhesive was the polychloroprene based adhesive specifically used in any of these applications.

4.2 The IR data suggests that the flexible foam in sample #67, is consistent with a closed-cell, plasticized polyvinyl chloride (PVC) foam containing a nitrile rubber. Further evidence suggests that the red material found on both sides of the foam is the same. The unknown red material is characteristic of a resorcinol based, two-part room temperature curing adhesive containing a high concentration of a dye much like an orange cobalt complex azo dye. Use in dyes, pharmaceuticals and as a cross-linking agent for Neoprene™ are some of the applications of resorcinol products.

4.3 The spectrum for the "clean" or non-contaminated side of sample #70, was similar to a graft-copolymer of acrylonitrile and styrene on chlorinated polyethylene, probably coated with a flame retardant material. The red unknown material in sample #70 exhibited properties much more characteristic of a polychloroprene based contact adhesive. The IR data suggests that present here is a product more consistent with one like the Scotch-Grip™ adhesive cement reference.

4.4 The material of sample #73 was buckled and contorted as though it had been exposed to heat. The spectrum for the "clean" side of the sample, was consistent with a graft-copolymer of acrylonitrile and styrene on chlorinated polyethylene, probably coated with a flame retardant material. The contaminated side of the sample was not red but more tan or red-brown in color. The material appeared to be in an advanced state of oxidation and evidence further indicated that the sample had been hydrolyzed. The IR data indicates that the unknown material is a mixture, the major component of which is a product most consistent with a polymethacrylamide. It is not unreasonable to expect however, that a polychloroprene based substance could also be present.

4.5 The gold glazed looking material removed from the darker side of sample #74, was identified as an acrylic polymer. The black looking material from the darker side of the metal was identified as a phthalate resin product, probably a Dacron™ filler. The presence of an anti-static agent was also detected. The same organic presence was observed on the lighter side of the metal sample although it was much less abundant. Since it is plausible to expect similar results from these materials, they were not examined further. There was a "soot" like substance present on this side that was not found on the previous side. This soot material was extracted, concentrated to dryness and analyzed. The IR data indicates that the major component of the "sooty" material is a zinc oxide which could be the oxidized phase of a zinc based polyvinyl chloride stabilizer.

INVESTIGATOR: _____

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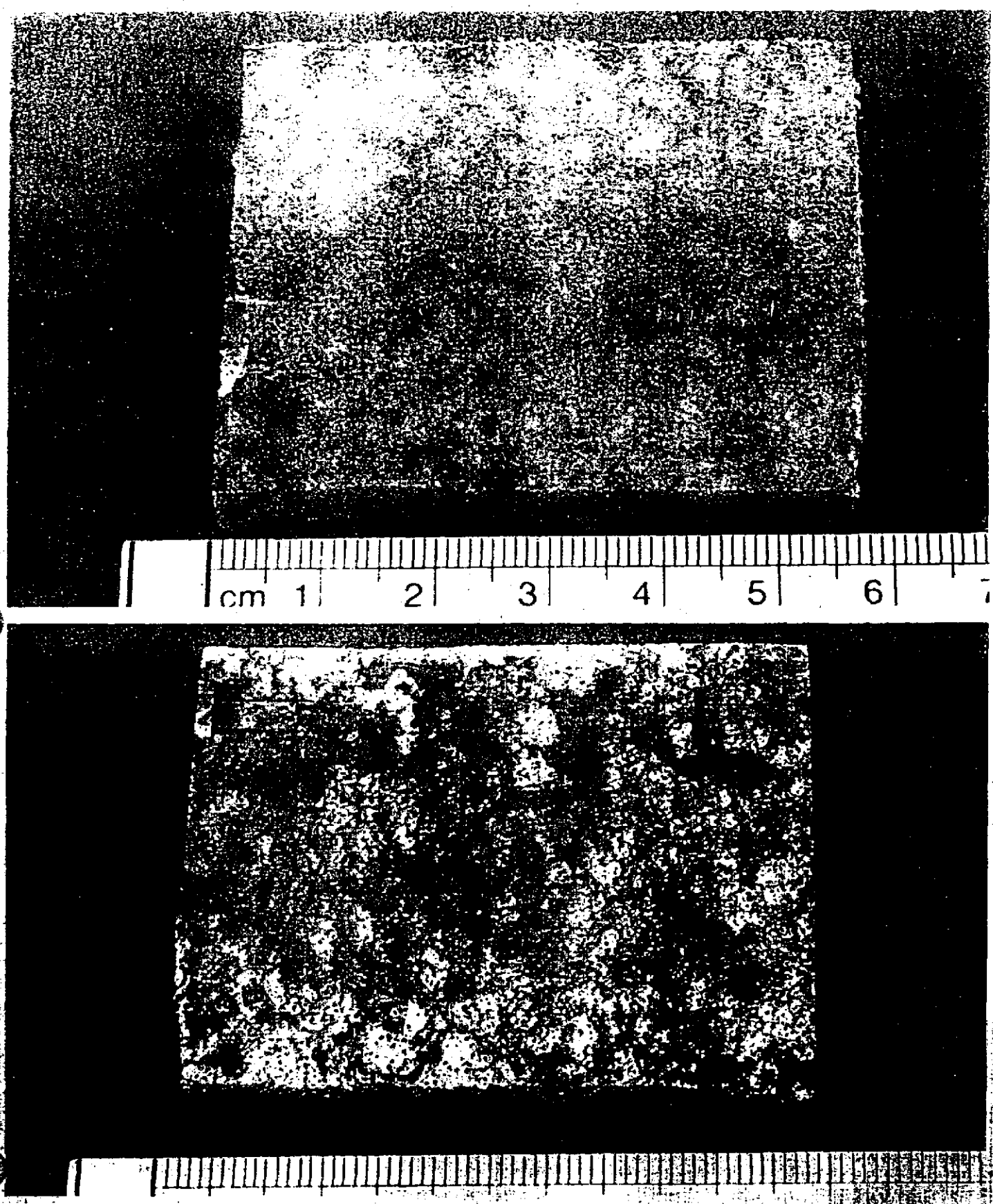

Figure 1. Sample #67, Row #19, Seat #2 Heavy and light coated sides.

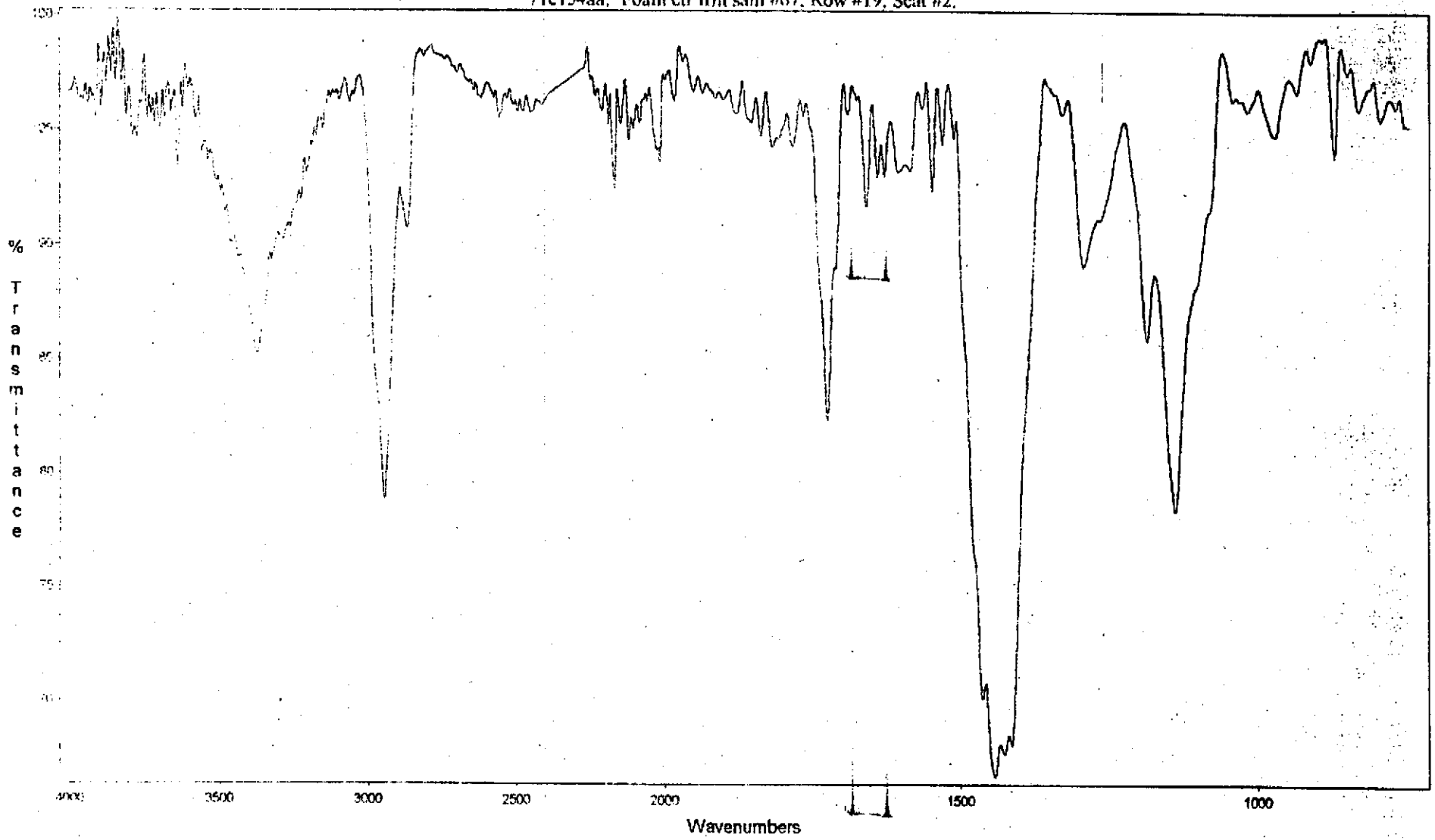

Figure 2. Center of flexible foam material.

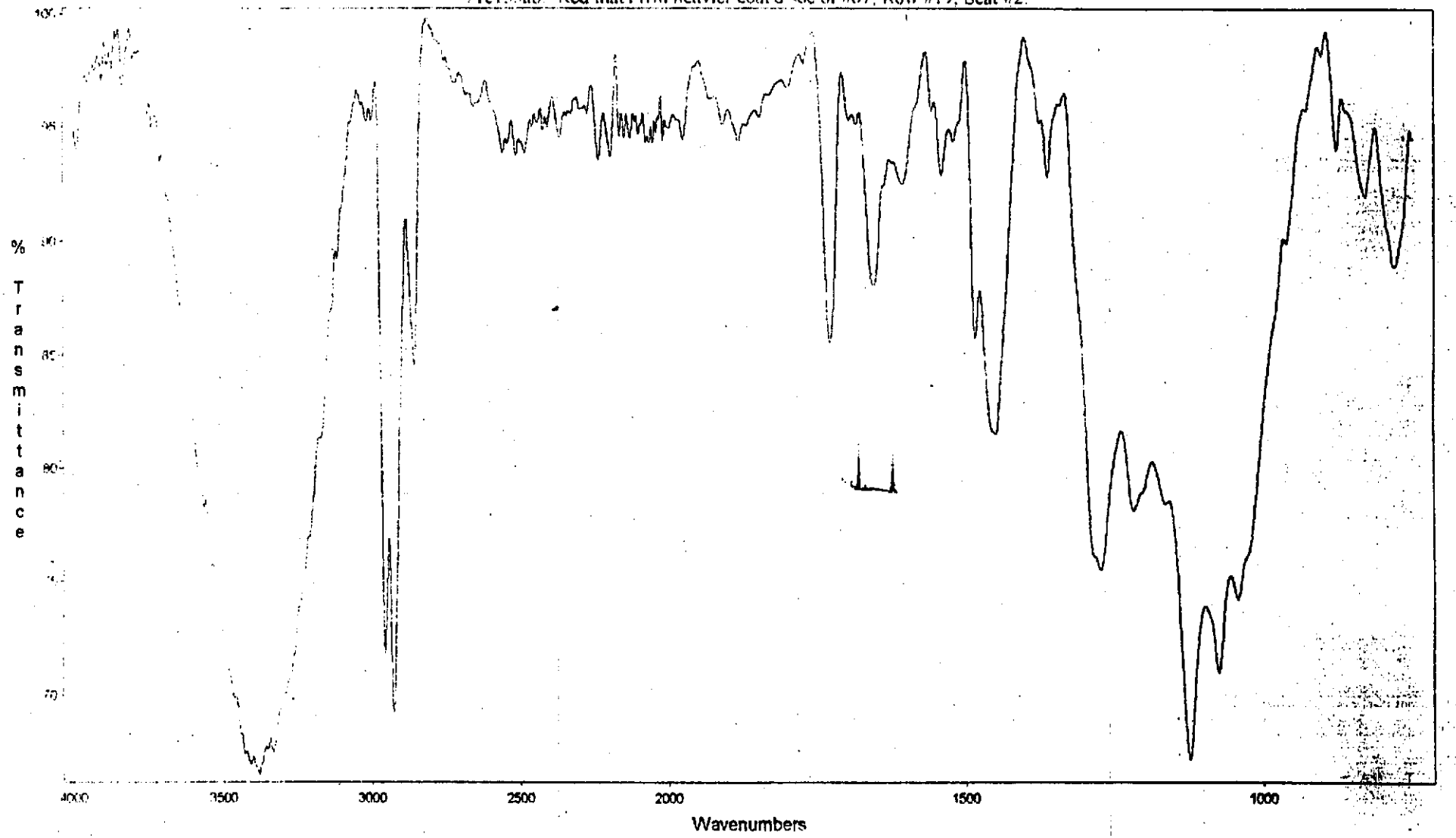

Figure 3. Heavier coated side of foam material.

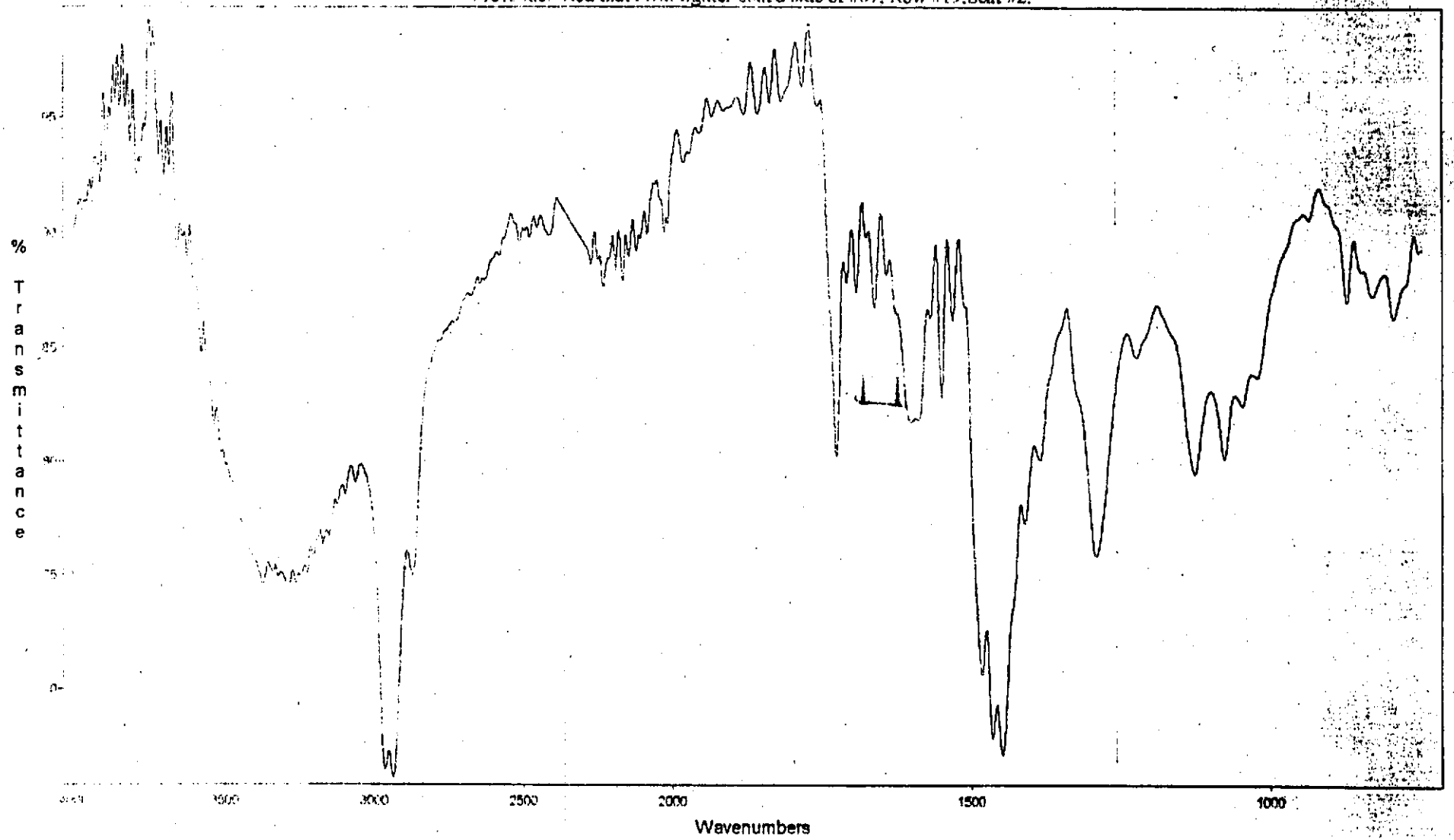

Figure 4. Lighter coated side of foam material.

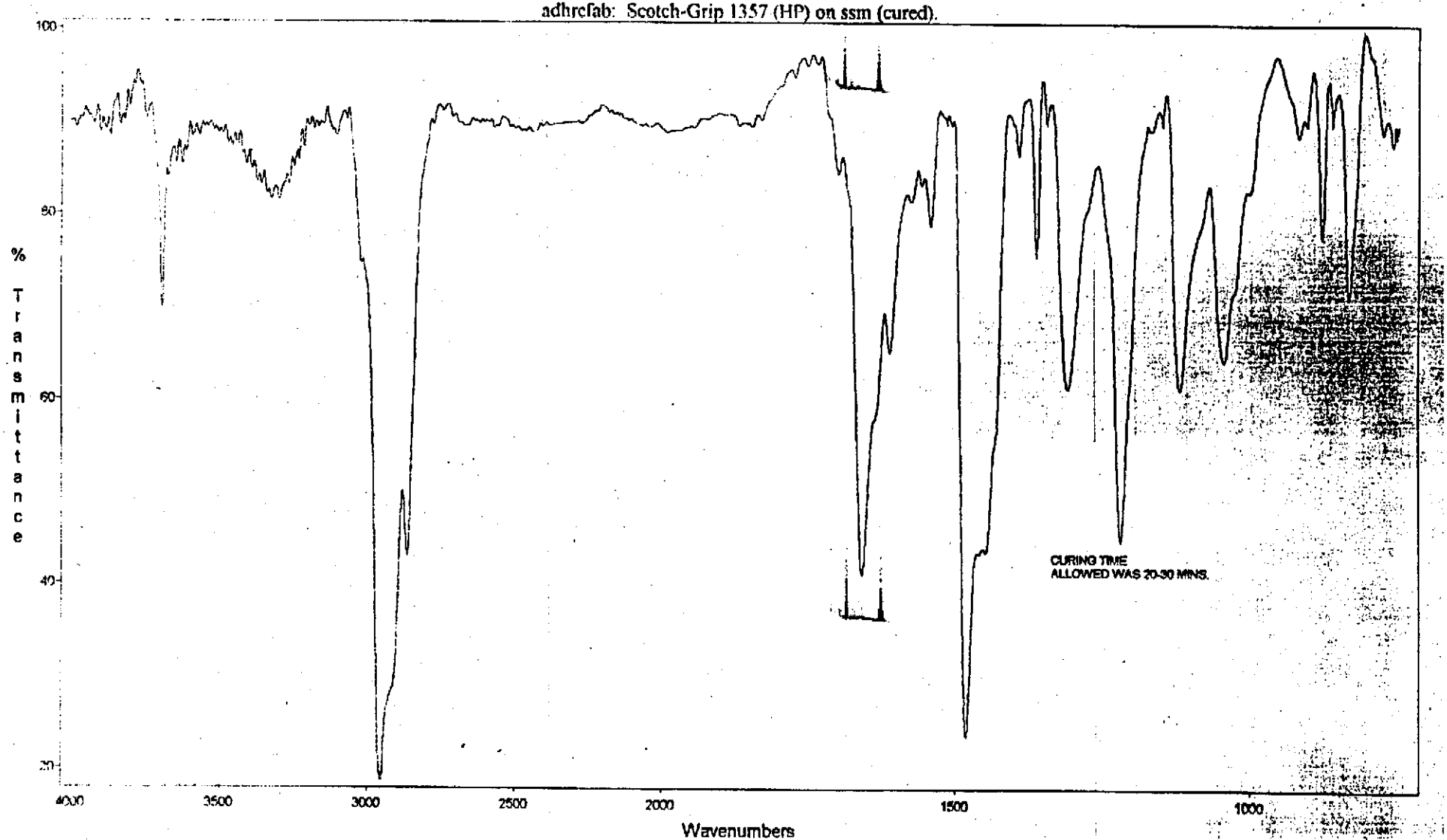

Figure 5. Adhesive reference.

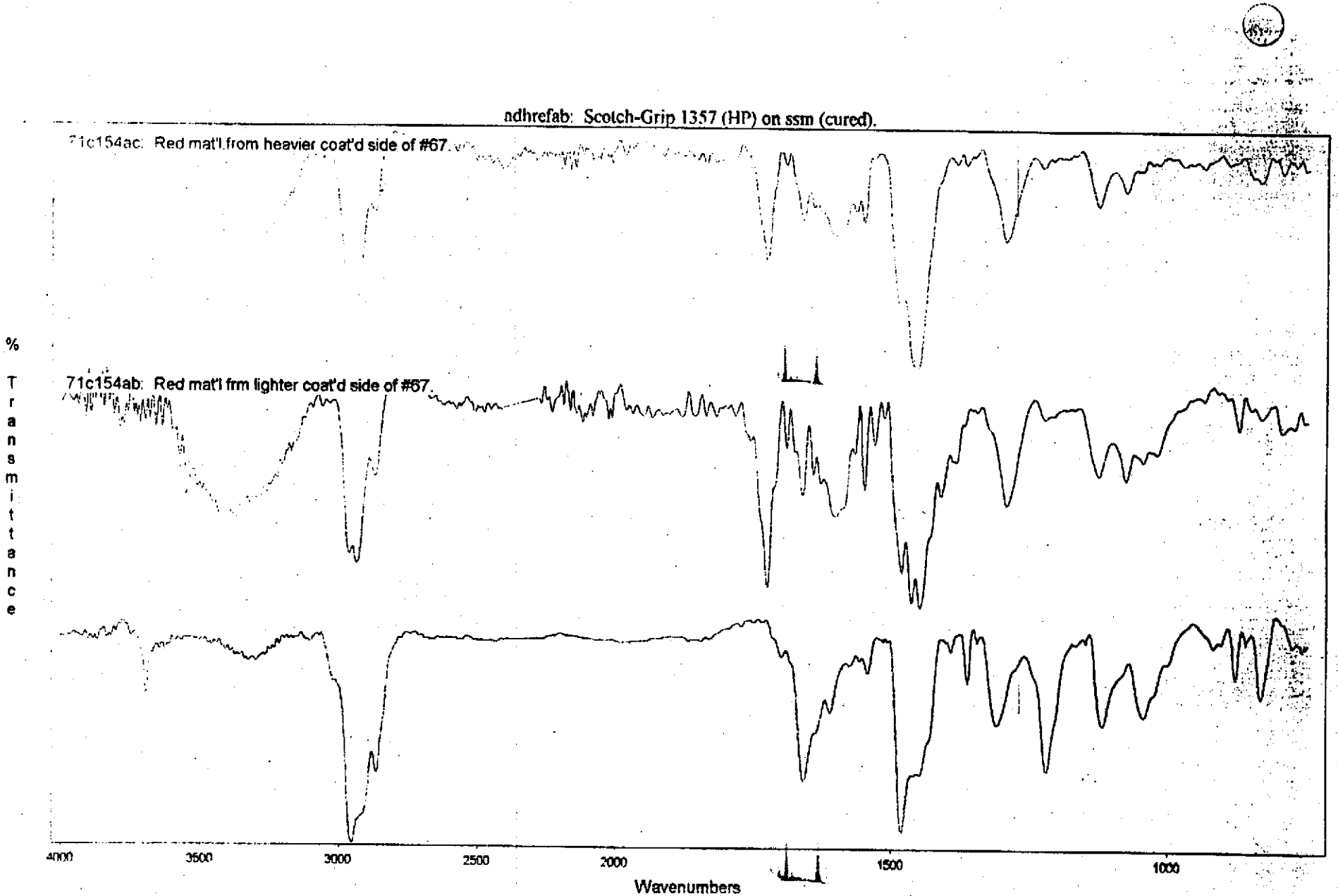

Figure 6. Spectral comparison with adhesive reference material.

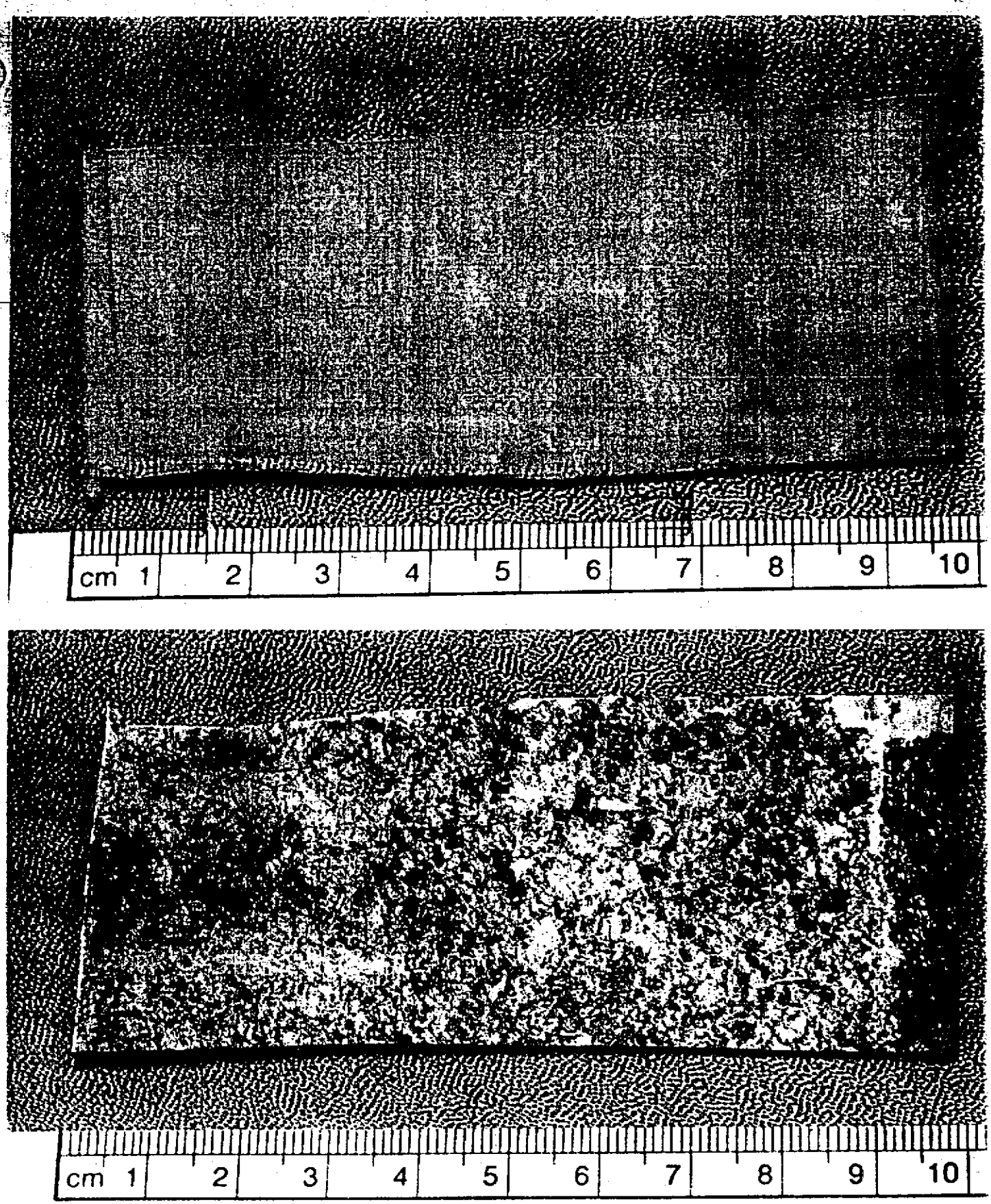

Figure 7. Sample #70, Row #17, Seat #8.

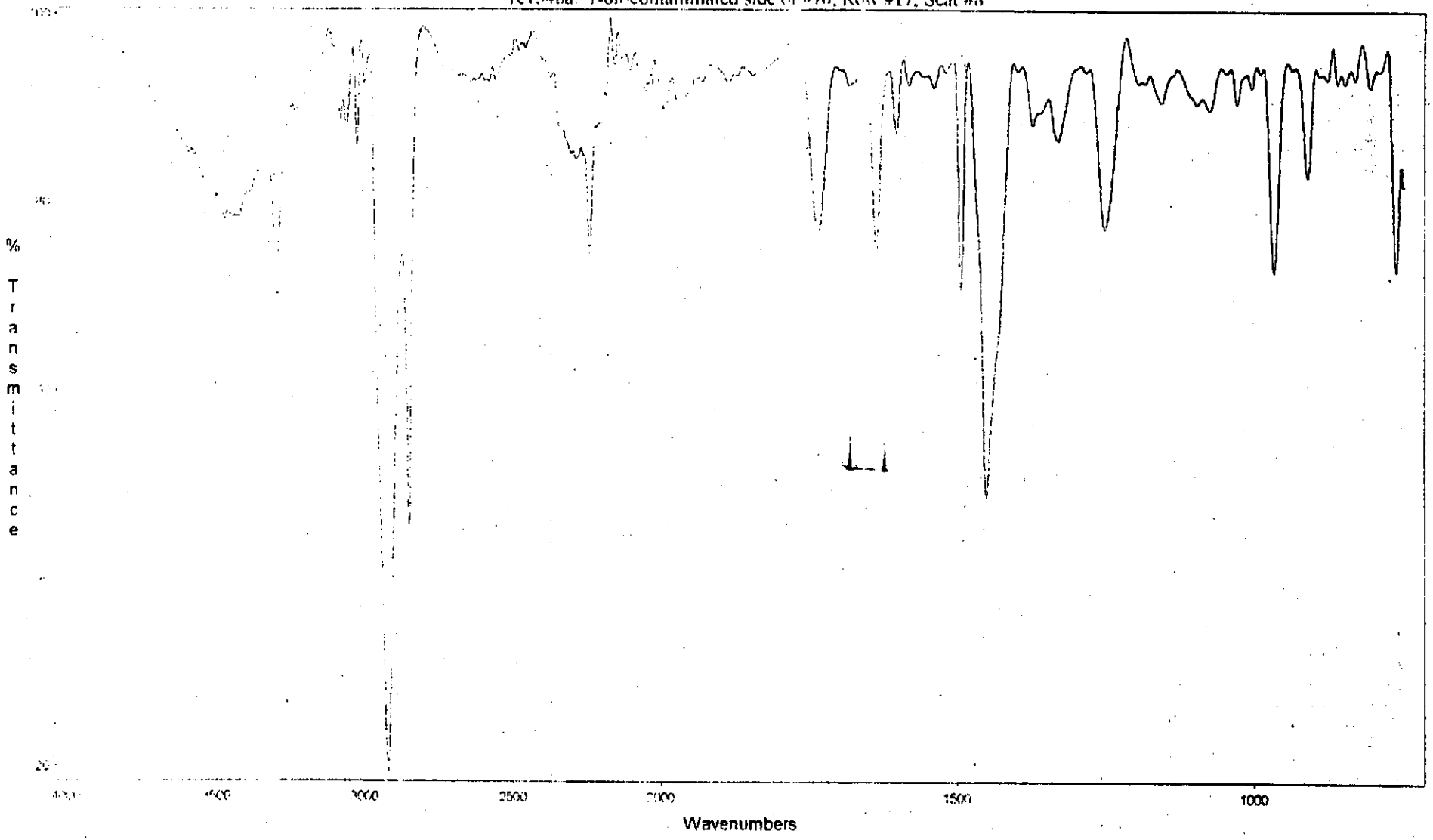

Figure 8. IR spectrum of "clean" side of sample #70.

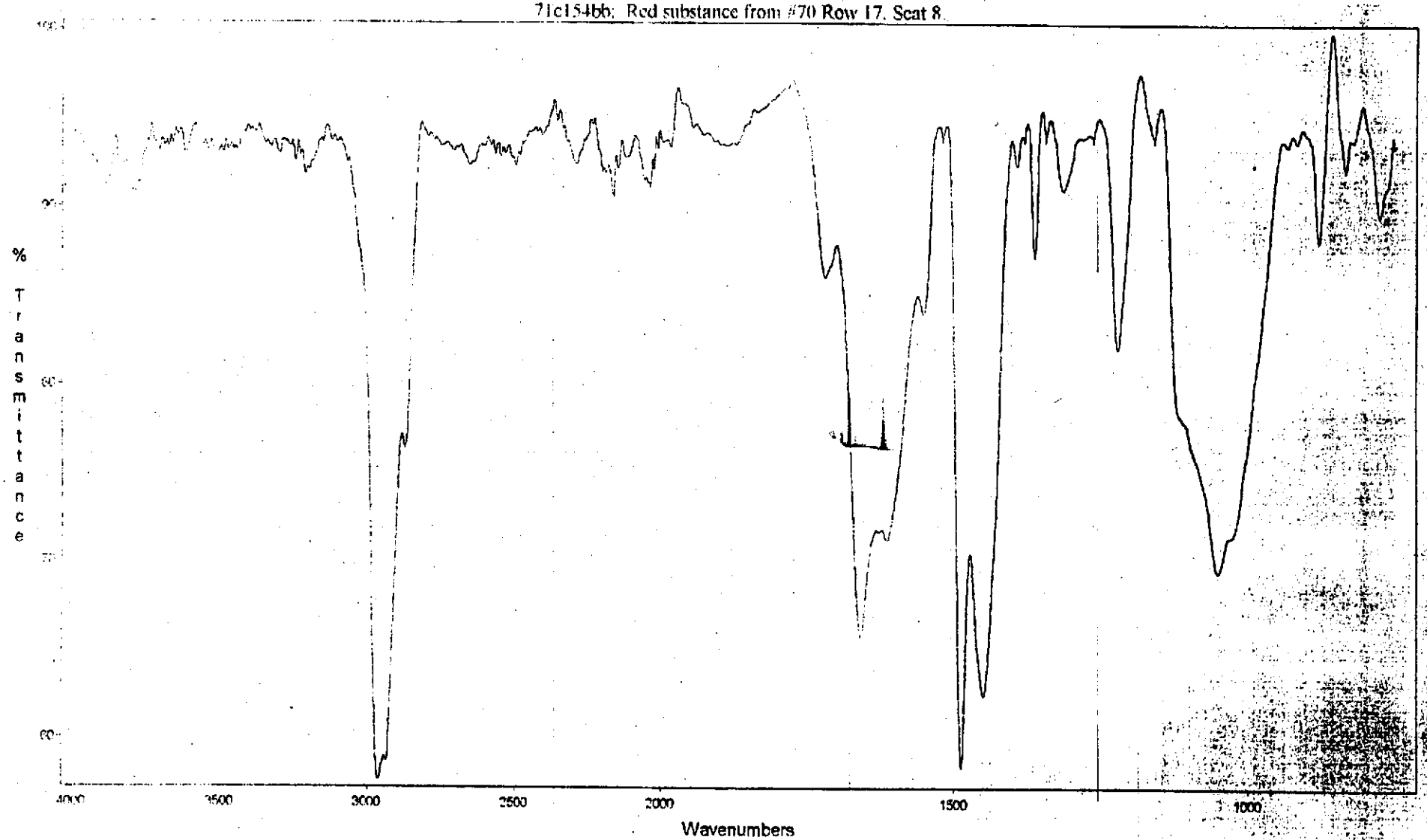

Figure 9. IR spectrum of red substance from sample #70.

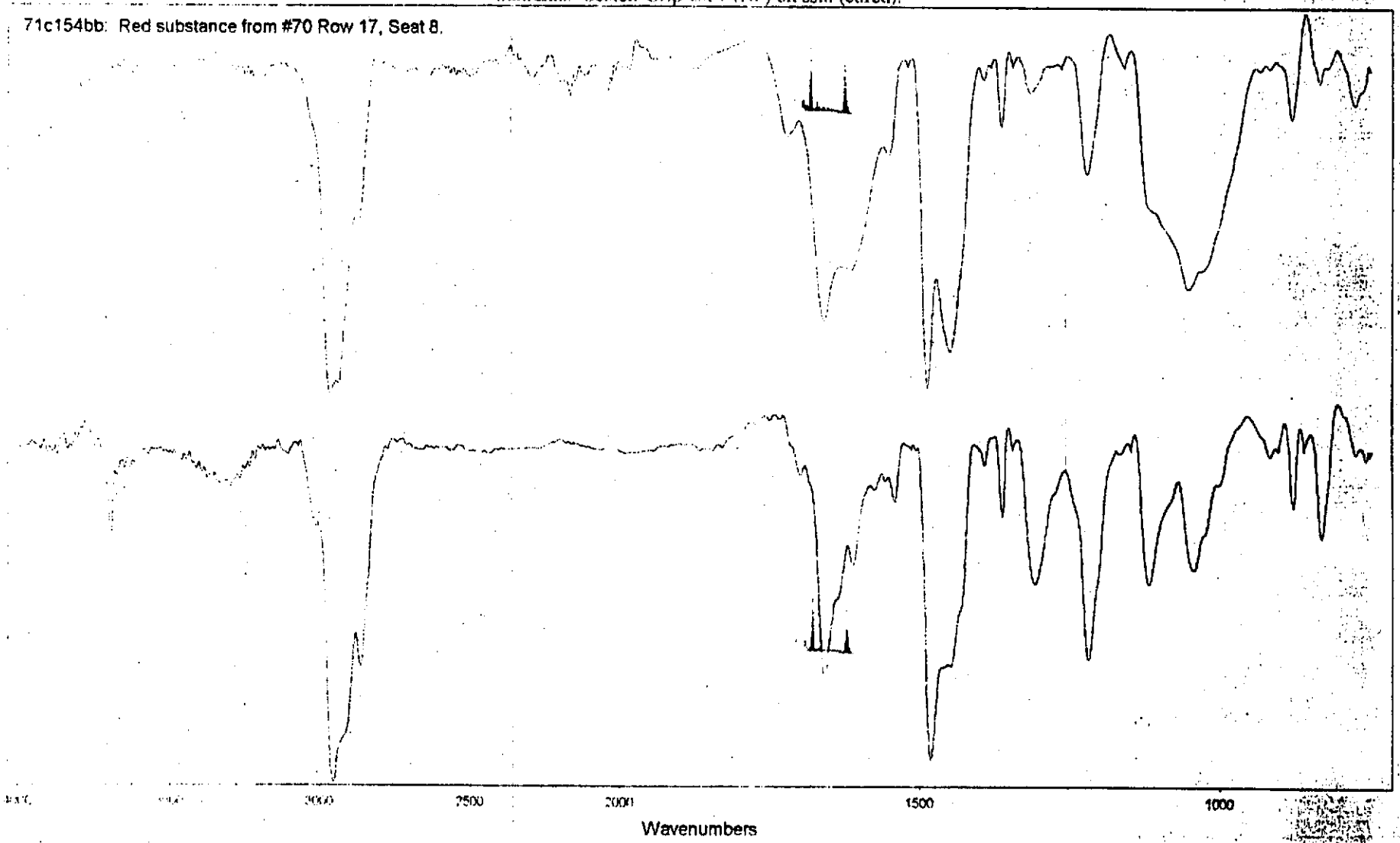

Figure 10. Spectral comparison of adhesive reference to red material.

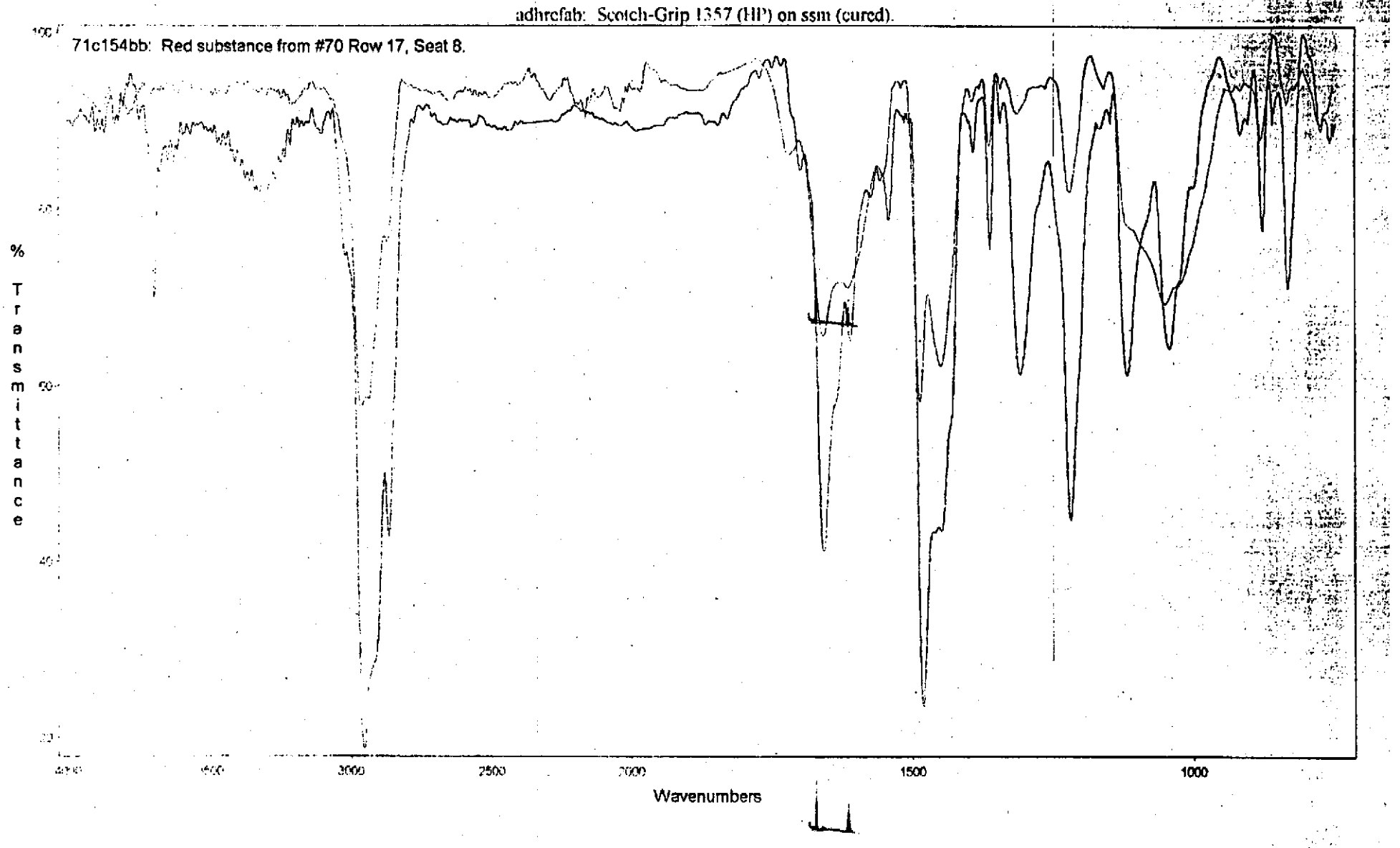

Figure 11. Spectral overlay of adhesive reference with red material.

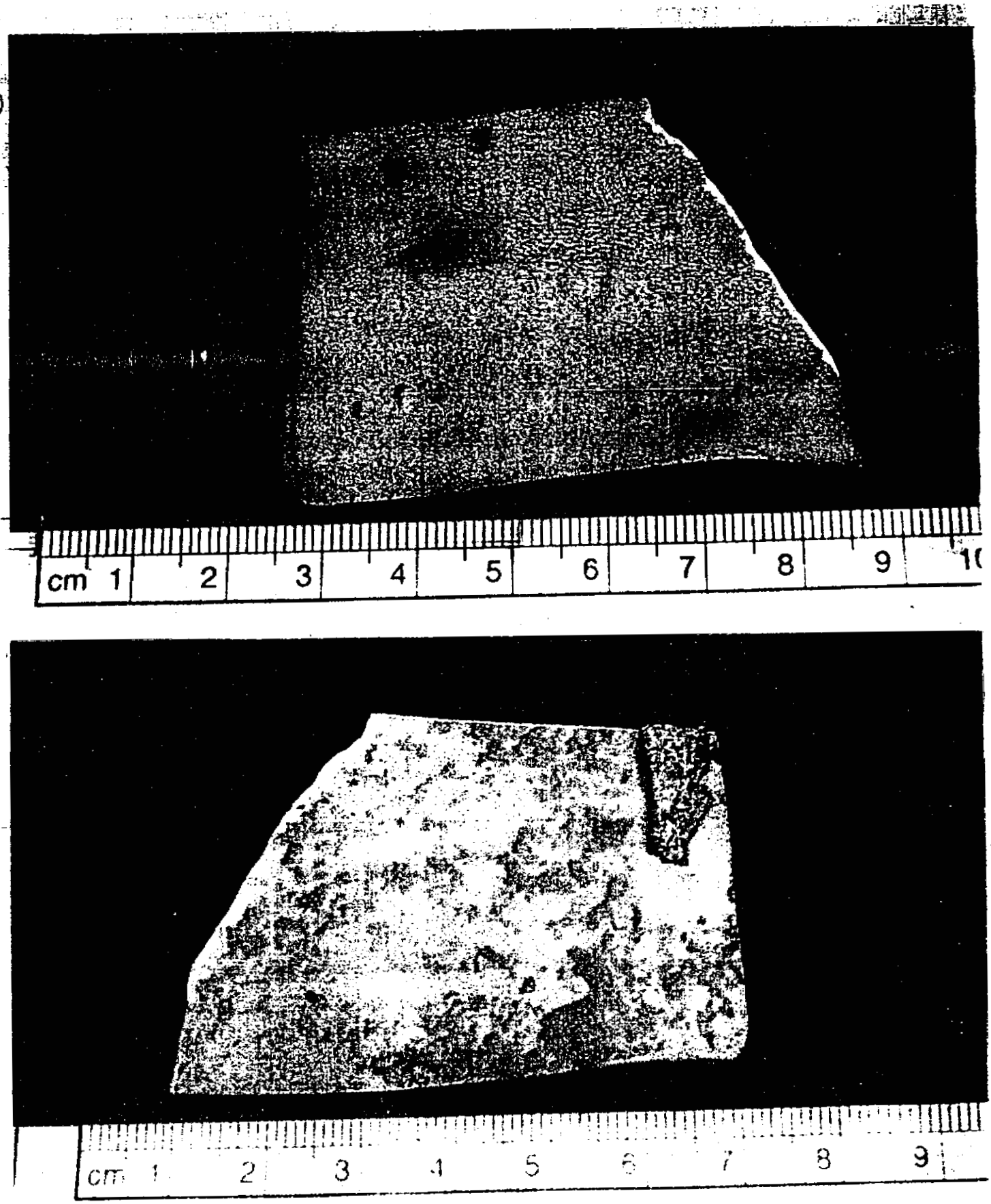

Figure 12. Sample #73, Row #27. Seat #2.

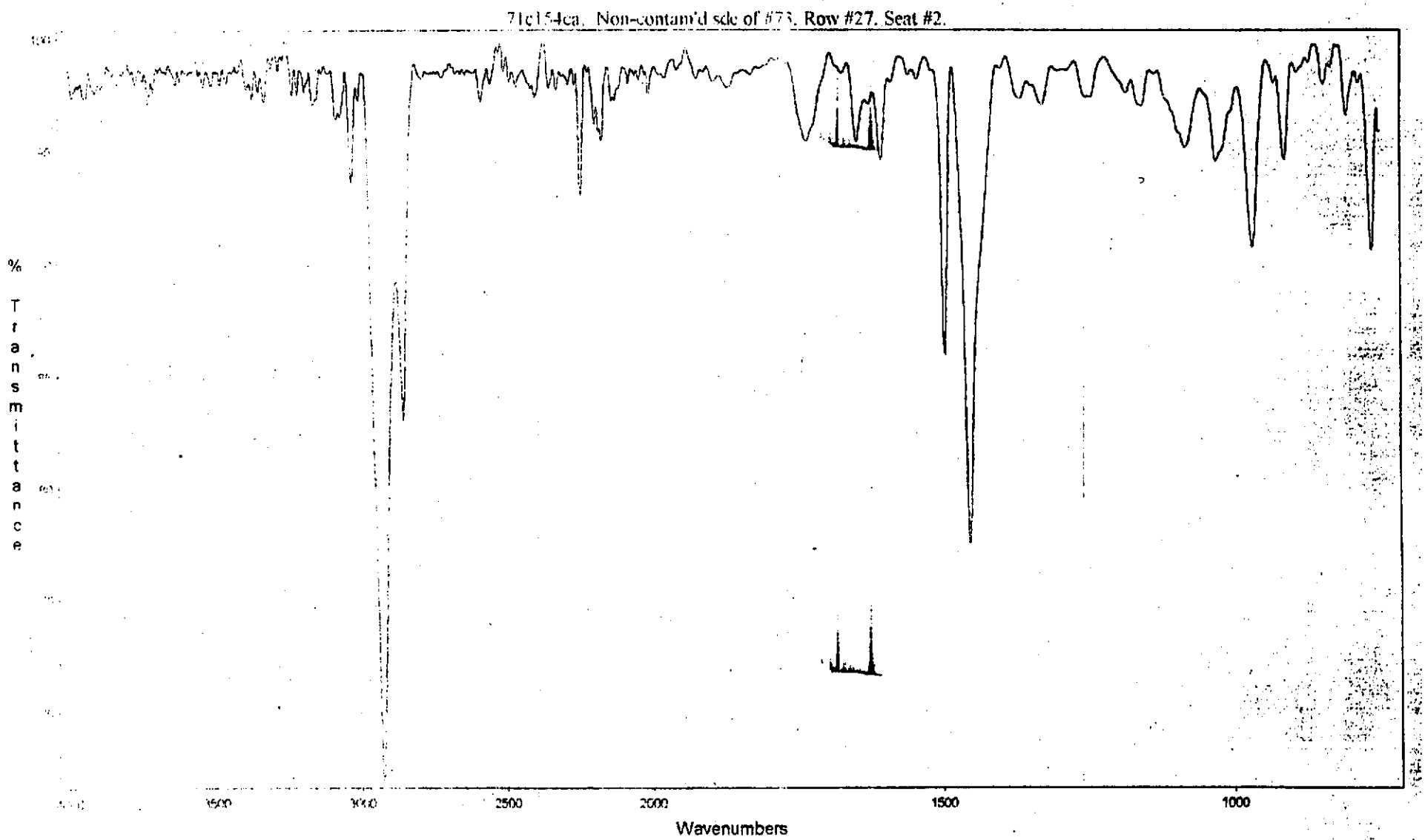

Figure 13. IR spectrum of "clean" side of sample #73, Row #27, Seat #2.

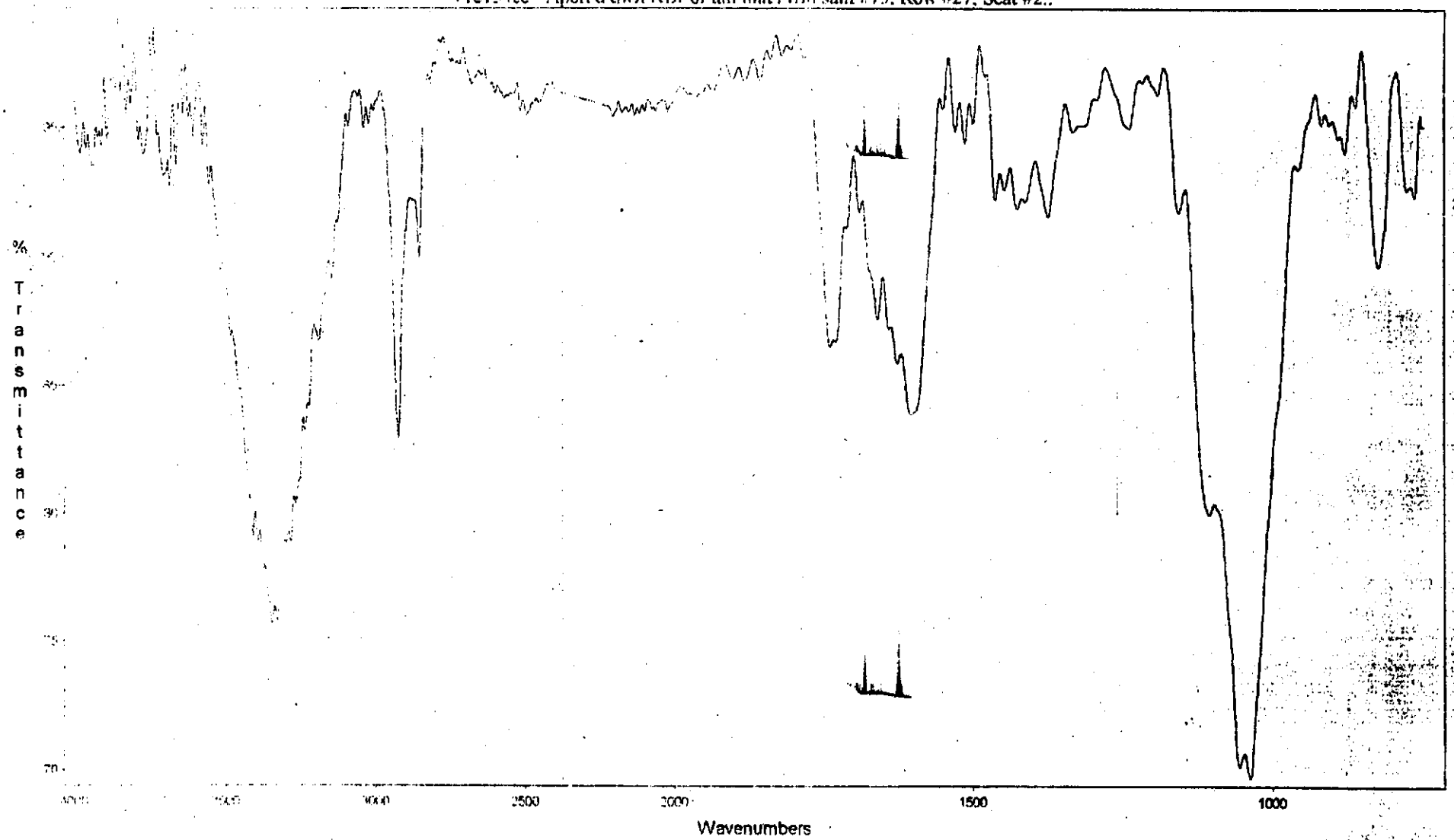

Figure 14. IR spectrum of contaminated side of sample #73, Row #27, Seat #2.

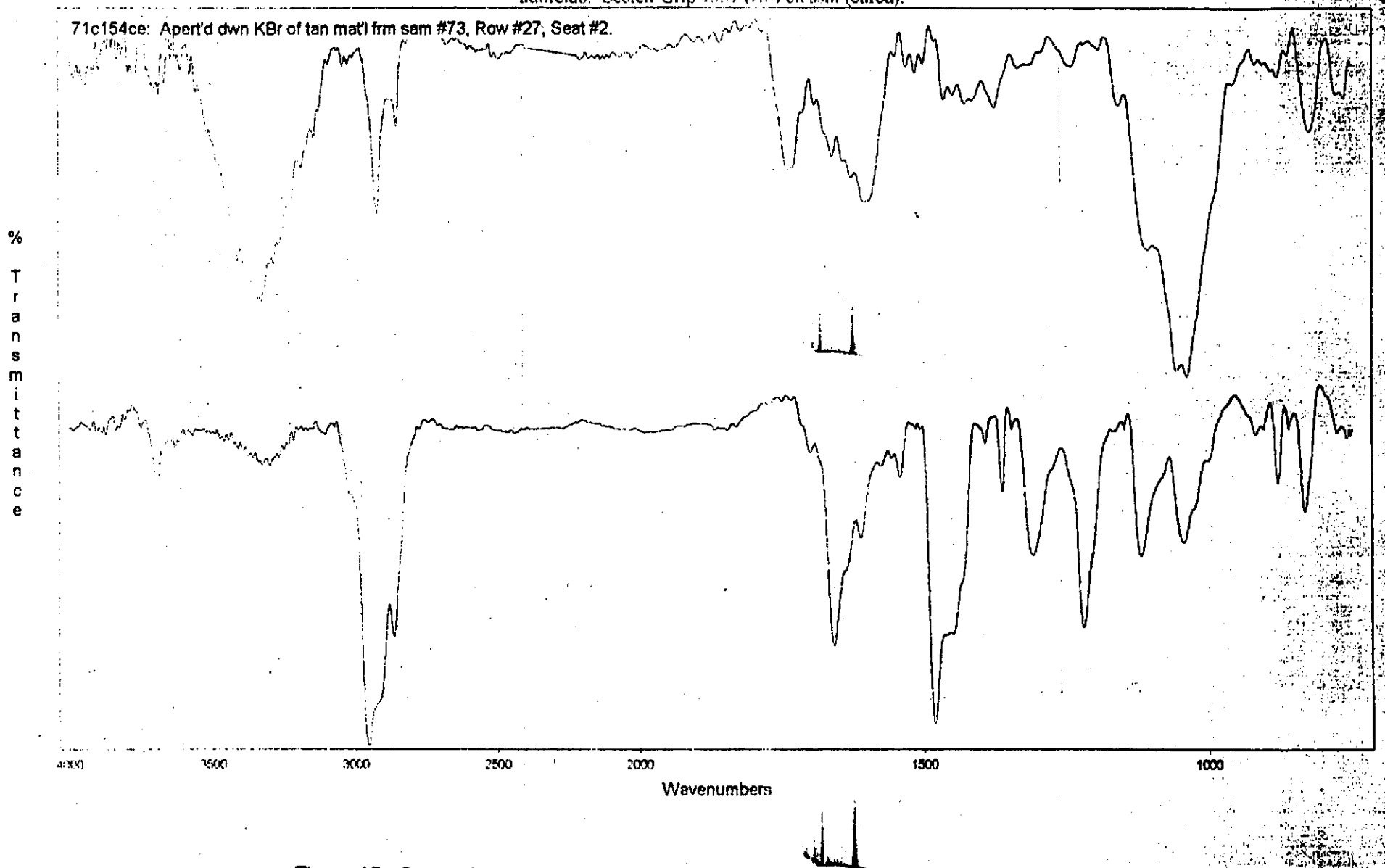

Figure 15. Spectral comparison of adhesive reference with contaminant of sample #73.

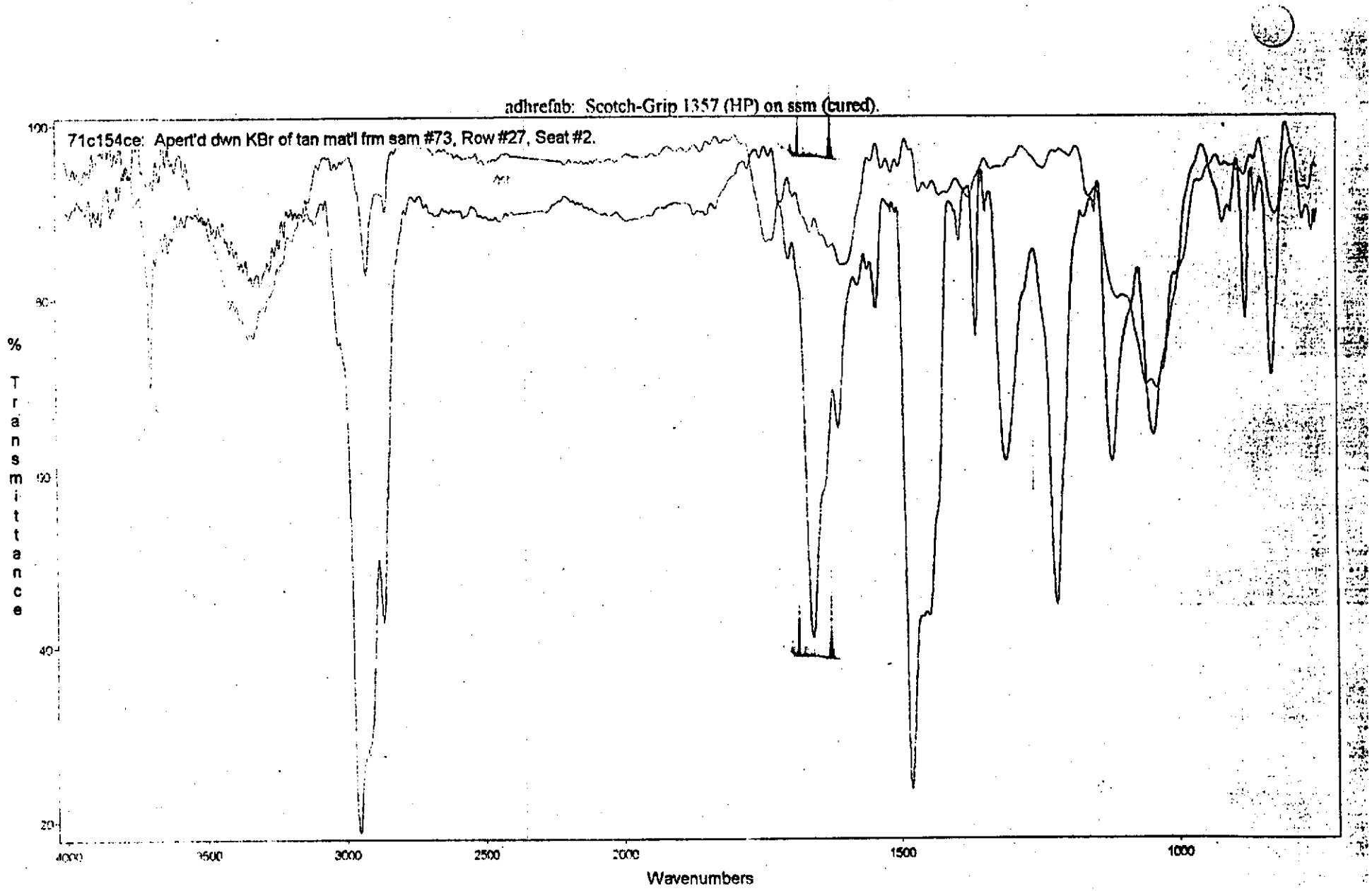

Figure 16. Spectral overlay of adhesive with contaminant.

Figure 17. Sample #74, Row #24, Seat #7.

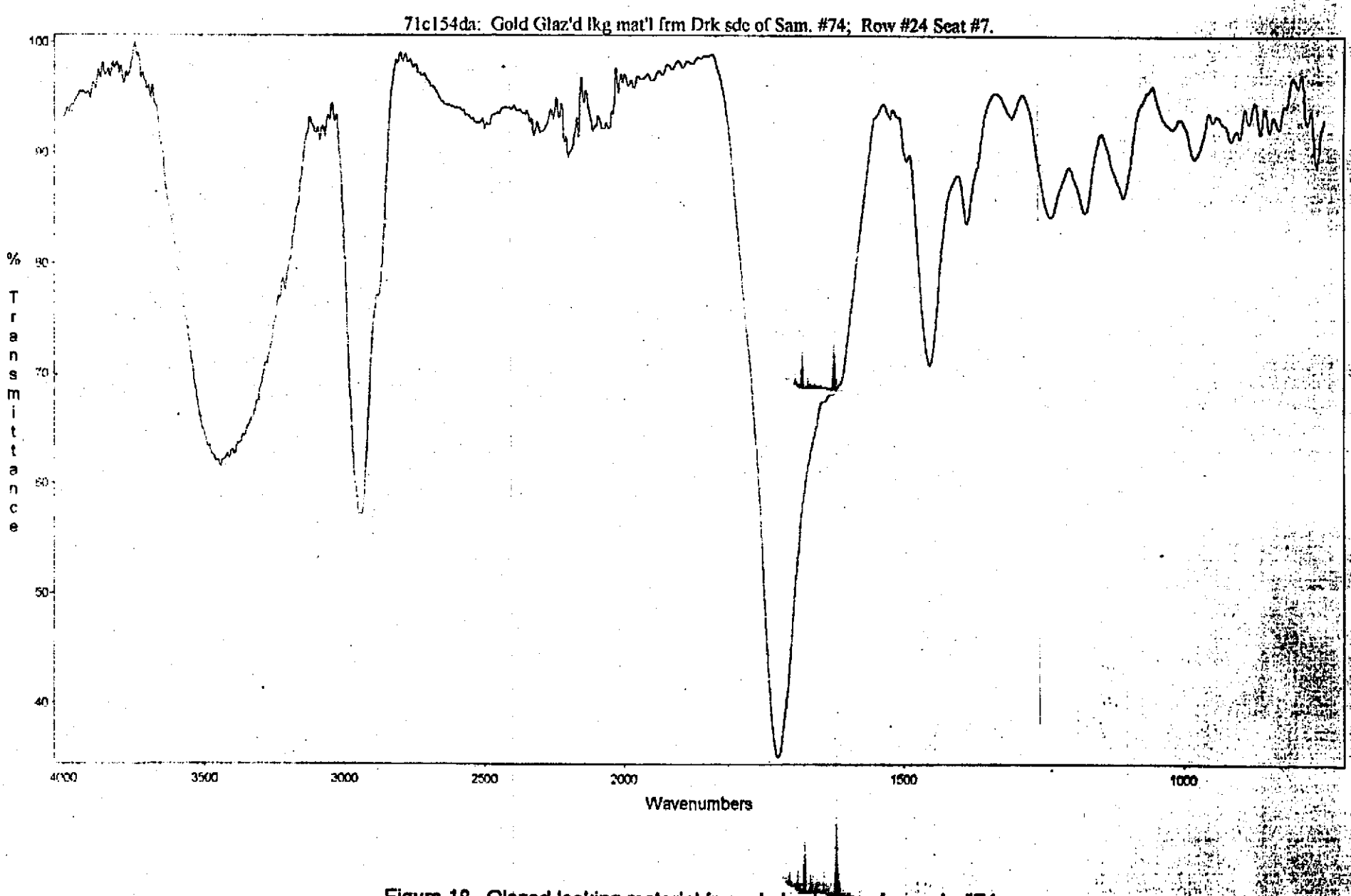

Figure 18. Glazed looking material from darkest side of sample #74..

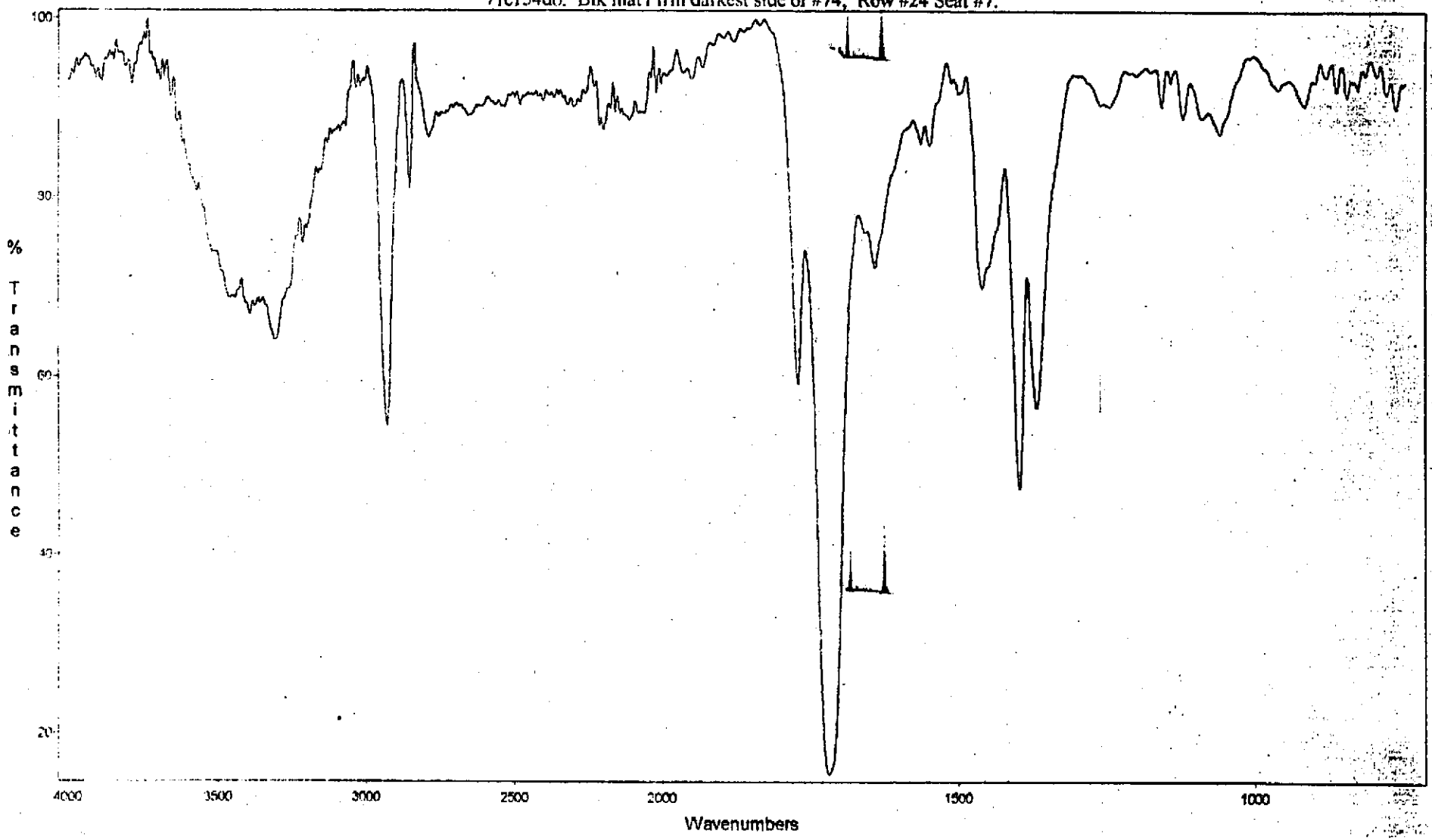

Figure 19. Black material from darkest side of sample #74.

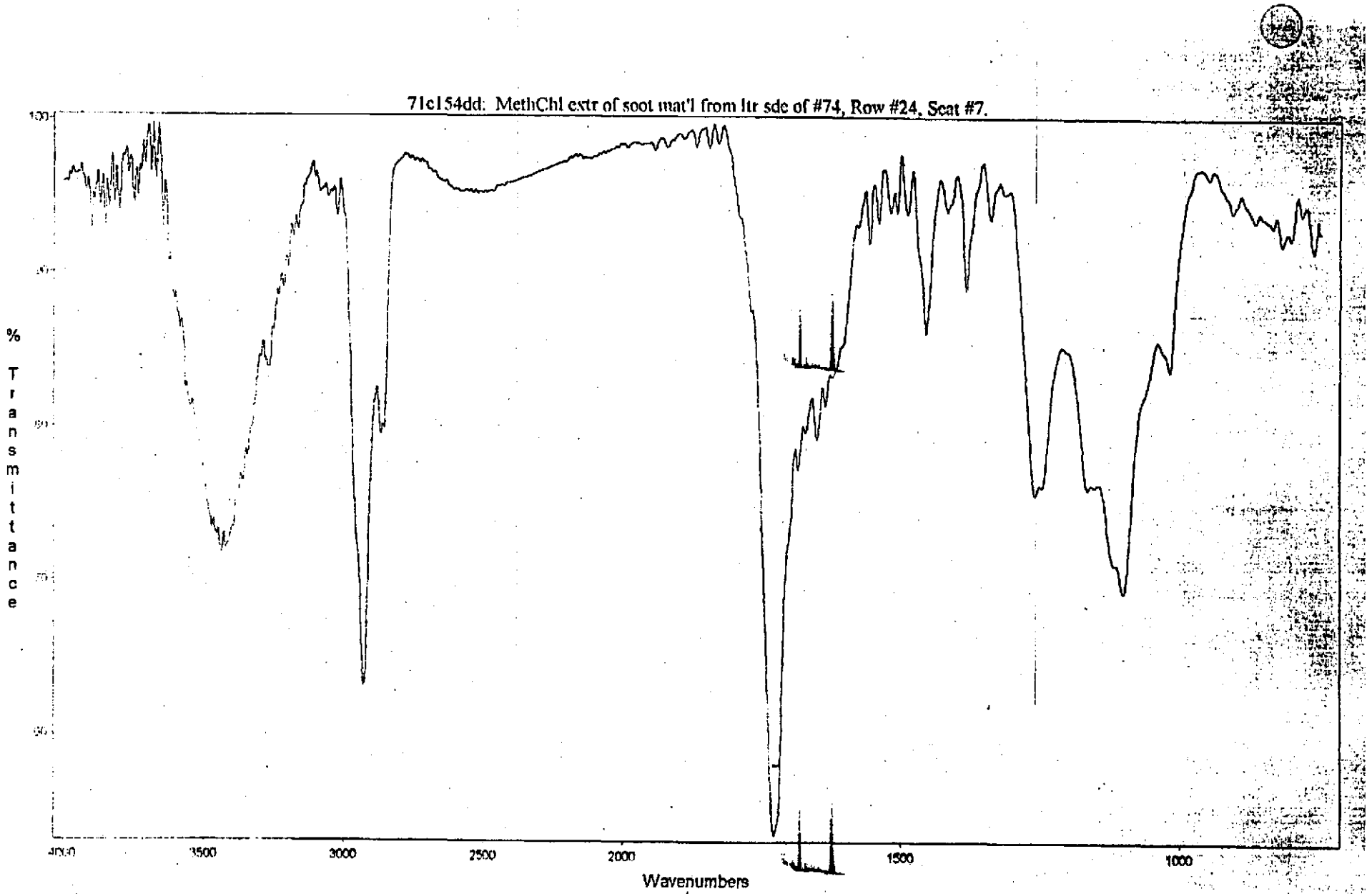

Figure 20. Extraction of "sooty" material from lighter side of sample #74.