CHARACTERIZATION OF CHRYSOTILE ASBESTOS IN AUTOMOBILE BRAKE DRUM DUST BY TRANSMISSION ELECTRON MICROSCOPY (TEM)

Krishna Seshan and Glenn R. Smith*

Department of Materials Science and Mineral Engineering, and Materials and Molecular Research Division, Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720 and *Air and Industrial Hygiene Laboratory, California State Health Department, Berkeley, California 94704.

This study supports other work that automobile brake drum dust is a source of partially altered and unaltered chrysotile asbestos (1-3) and suggests that dark-field electron microscopy could be used to identify the source of the fibres. These results are in contradiction to those who report that high temperatures reached during braking reduce a majority of the chrysotile to forsterite (4,5).

Automobile brake drum dust was directly transferred to formvar coated grids and coated with carbon on both sides. The grids were then examined with a Siemens 1A and a Philips 301 at 100 kV.

Intact chrysotile fibre bundles with some phenolic opaque binder is shown in Fig. 1 displaying partially deformed internal canals, but does not show gross morphological change. Unaltered chrysotile is shown in Fig. 2a and was confirmed by selected area electron diffraction (SAED), see Fig. 2. The calculated d-spacings correlated with those of Yada's (3). As previously reported (1) a variety of chrysotile deformation products are found in brake drum dust shown in Figs. 3 and 4. Fig. 3 shows a fibril fragmented by deformation. Fig. 4 shows single fibrils with canals intact. However, the SAED patterns in Figs. 3a and 4a are atypical of chrysotile and are streaked perpendicular to the a^* direction which may be caused by surface deformation and macroshear. High resolution dark-field microscopy was used to study the deformations in detail as shown in Fig. 5. The bundle is mottled showing surface deformation with grains much larger than those of standard chrysotile. This suggests that dark-field electron microscopy can be used to identify the source of fibres found in air pollution samples. This deformation and grain growth is probably due to mechanical and thermal stresses experienced by the bundle in the brake drum.

Less than one percent chrysotile and no forsterite was found in the drum dust by light optical microscopy (LOM) and x-ray diffractometry (XRD). It has been previously pointed (2) out that the fibre sizes and concentrations are often below the limits of detection of LOM and XRD.

Acknowledgements - Thanks to Dr. J. J. Wesolowski and Professor G. Thomas for use of the TEM facilities and to Drs. A. Langer and A. Rohl for discussion. Financial support is appreciated from the U.S. Energy Research and Development Administration through the Materials and Molecular Research Division of the Lawrence Berkeley Laboratory.

1. A. Rohl, A. Langer, et al., Environmental Research 12, 110 (1976).
2. Ibid., Proceedings of the Royal Soc. of Med., 7D, 32 (1977).
3. J. Alste, et al., Atmospheric Environment 10, 583 (1976).
4. R. J. Lynch, 30th., Ann. Meeting Amer. Conf. of Govt. Hygienists, St. Louis, Mo (1968).
5. C. J. Jacko, et al., Auto Engineering 81, 38 (1973).

8001 0633