O12. AFM studies of the ultrastructural and nanomechanical properties of commercial pressure sensitive adhesives for forensic analysis

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Pressure sensitive adhesives (PSAs), such as those used in packaging and adhesive tapes, are very often encountered in forensic investigations. It is broadly acknowledged that routinely used techniques (FT-IR and pyrolisis-gas-chromatography-mass-spectrometry) in forensic science laboratories to identify chemical constituents for discriminating PSAs are mostly effective. In this presentation, the potential of using Atomic Force Microscopy (AFM) to derive additional analytical information from PSAs will be demonstrated.

AFM was used to illustrate differences in the ultrastructural and nanomechanical properties of three visually distinguishable PSAs (transparent cello tape made of regenerated cellulose, brown packaging tape made of a waterproof polypropylene film**,** and green electrical insulation tape made of a PVC film) to first test the feasibility of using this technique.

Subsequently, AFM was used to detect nanoscopic differences between three visually indistinguishable PSAs (colourless and transparent OPP packaging tapes from three UK distributors: Niceday - Large core office, Henkel – Adhesion J1626, and Eureka - Large clear tape). Roughness analysis carried out on the AFM images of these PSAs showed that the Henkel tape was quite smooth, while the presence of two distinct (hard and soft) phases on the surface of the Niceday tape makes its surface rougher as compared to the Henkel tape. Finally, Eureka transparent cello tape showed a reasonably uniform morphology as shown by a decrease in the surface roughness as compared to that of the Niceday tape. These results were confirmed by AFM force mapping. The 2-D adhesion energy maps of the three indistinguishable cello tapes showed a quite uniform distribution of the hard phase in the Niceday tape, while the energy map for the Henkel tape showed greater homogeneity compared to the Niceday tape. The energy map of the Eureka tape was found to be very uniform as compared to the Henkel and Niceday tapes.