Rapid Analysis of Glues, Cements, and Resins

DART™ can be used to analyze polymers, cements, resins, and glues by increasing the gas temperature to 450-550° C to induce pyrolysis. This has been applied to a variety of glues and resins, including epoxies, polyimide resins, PVD cement, and cyanoacrylates. Examples are shown here for cured and uncured epoxy resin and cyanoacrylate glues.

The DART was operated with helium in positive-ion mode. The gas heater was set to 475° C. Resins were cured in an oven for several hours before analysis; some resin samples had been cured for longer periods of time (months or years). Exact masses and accurate isotopic abundances were used to assign elemental compositions for peaks in the mass spectra. Nominal-mass spectra were exported into a library database in NIST format to facilitate identification of unknowns.

The black component (Figure 1) of a common binary quick-curing epoxy is found to be bisphenol A diglycidyl ether (DGEPA) and the white component(Figure 2) is the hardener DMP 30. The cured epoxy (Figure 3) shows some peaks common to both of these components, but new peaks are also observed from the polymerized resin.

Two different cyanoacrylate glues were examined. Both showed ethyl cyanoacrylate $[M+H]^+$ (m/z 126) and its fragments $C_4H_2NO^+$ (m/z 80) and $C_4H_4NO_2^+$. Product 1 also contained allyl methacrylate and a polymer component with ethylene oxide (EO) subunits. Product 2 contained the common plasticizers tributyl citrate and tributyl acetylcitrate.

Conclusion

Glues, cements, and resins can be analyzed by DART. Fingerprint mass spectra are produced, and common formulation components can be identified and confirmed by exact mass measurements.

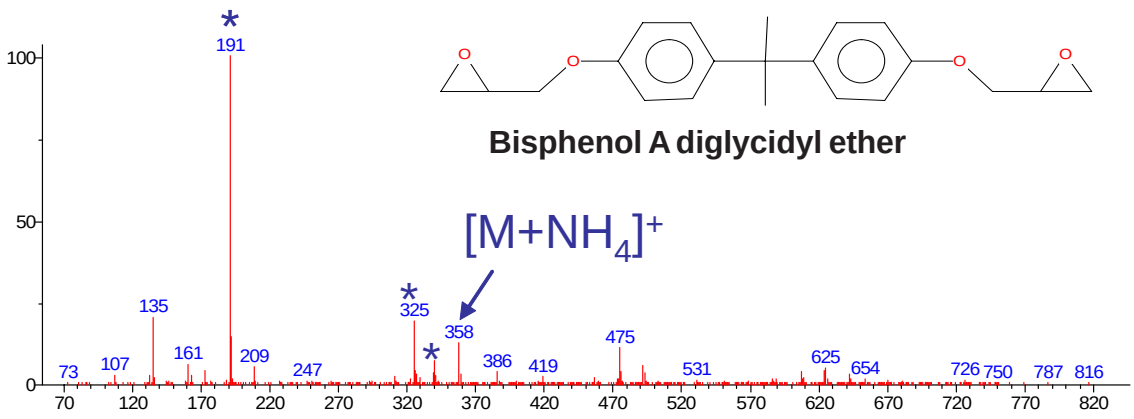

Figure 1. Uncured epoxy resin (black component)

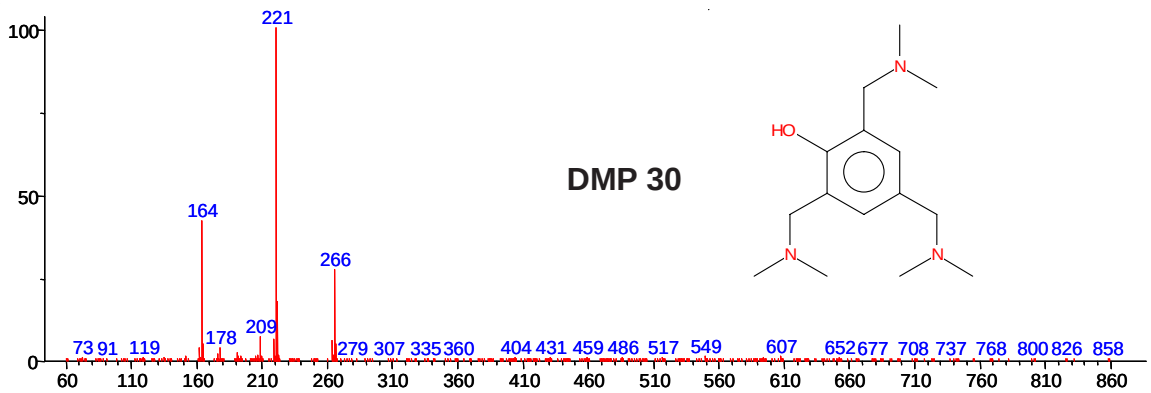

Figure 2. Uncured epoxy resin (white component)

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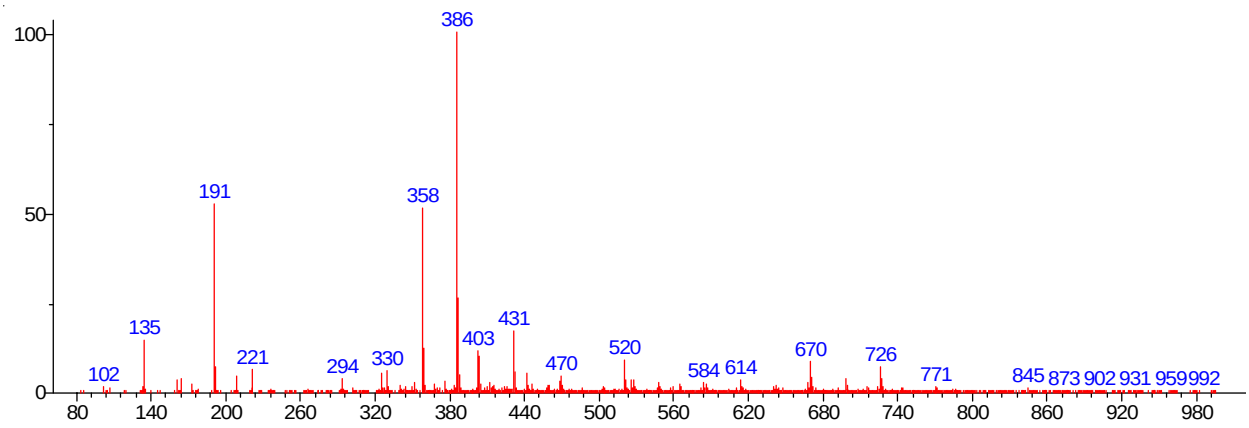

Figure 3. Cured epoxy resin on metal surface

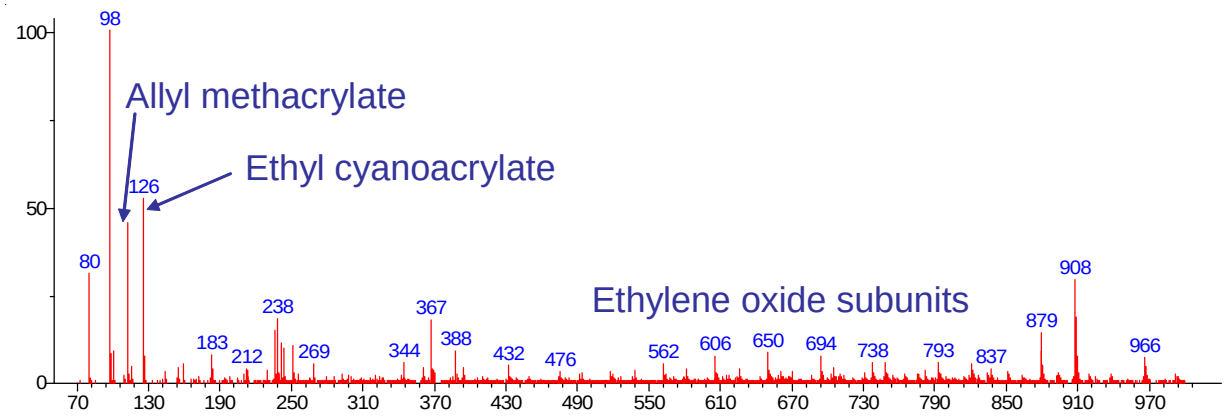

Figure 4. Cured cyanoacrylate glue product 1

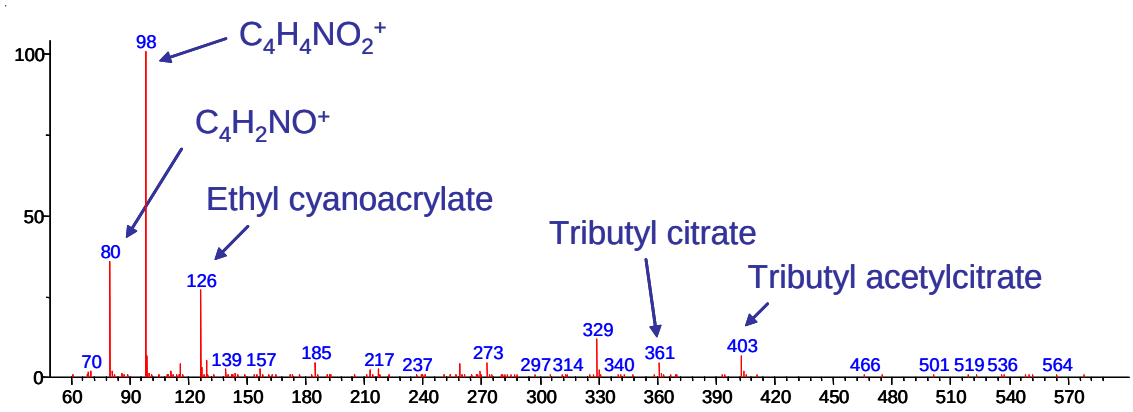

Figure 5. Cured cyanoacrylate glue product 2

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