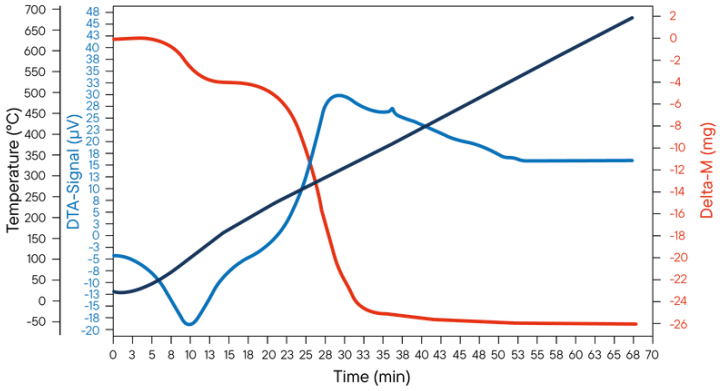
Thermal Analysis of Historical Violin Wood

Authentication of a 1723 Stradivarius Using Simultaneous Thermal Analysis

Thermal analysis is a valuable tool for investigating the composition, thermal stability and ageing behaviour of historical materials. In this application, the LINSEIS STA L81 was used to characterize the thermal decomposition of spruce wood from a 1723 Stradivarius violin, providing important information for its authentication and preservation.

Measurement Setup

- Instrument: LINSEIS STA L81
- Sample: Spruce wood from the top plate of a Stradivarius "Petite Violin" (1723)
- Temperature Range: RT – 700 °C
- Heating Rate: 10 K/min
- Atmosphere: Dynamic Air
- Gas Flow: 50 ml/min
- Measurement: TG + DTA
- Application: Cultural Heritage / Archaeometry / Wood Analysis



The simultaneous TG/DTA measurement clearly distinguishes three characteristic thermal decomposition stages:

- Release of moisture and volatile compounds below 180 °C
- Decomposition of cellulose, lignin and organic varnish components between 180 °C and 350 °C
- Formation of inorganic residues and ash above 350 °C

The thermal behaviour correlates well with complementary SEM/EDX and FTIR analyses, supporting the authentication of the historical violin.

Interpretation

The observed behavior can be attributed to:

- Moisture evaporation at low temperatures
- Thermal decomposition of cellulose and lignin
- Oxidation of organic constituents
- Formation of stable inorganic residues

This results in:

- Improved material authentication
- Reliable ageing assessment
- Characterization of thermal stability

Industrial Relevance

Simultaneous thermal analysis is widely used for the characterization of organic and inorganic materials in:

- Cultural heritage conservation
- Archaeometry
- Wood and biomass analysis
- Natural materials
- Conservation science
- Research institutes
- Museums
- Material authentication

Conclusion

The LINSEIS STA L81 enables precise simultaneous determination of mass changes and thermal effects over a wide temperature range. In this study, thermal analysis successfully characterized the ageing and decomposition behaviour of historical spruce wood and provided important information for the authentication of a 1723 Stradivarius violin. The results demonstrate how STA contributes to the investigation, conservation and scientific evaluation of valuable cultural heritage objects.

Source:
Sandu, I., Tănasă, P. O., Brînză, F., Vasilache, V., Drob, A., Drobotă, V.
Authentication of a Stradivarius "Petite Violin" Type from 1723.
Applied Sciences, 2023.
Adapted from simultaneous thermal analysis (TG-DTA) measurements performed using a LINSEIS STA L81 (formerly designated as STA PT 1600).