

Phase determination of polymer samples with ARL EQUINOX 100 benchtop X-ray diffractometer

Authors: Dr. Simon Welzmler, Ju Weicai, XRD Application Specialists

Introduction

In the last century, our society shifted from the age of metals to the age of plastics, from which a tremendous demand on polymers resulted. Therefore, quick and convenient analytical methods are required to analyze the vast number of different polymer compounds, as the physical properties strongly depend on the structure and nature of the polymers. Using X-ray diffraction (XRD) it is possible to conveniently determine the crystallographic structure as well as the type of polymer materials.

Instrument

The Thermo Scientific™ ARL™ EQUINOX 100 X-ray diffractometer employs a custom-designed Cu (50 W) or Co (15 W) micro-focus tube with mirror optics. Such a low wattage system does not require external water chiller or other peripheral infrastructure, allowing the instrument to be easily transported from the laboratory to the field or between laboratories.

Figure 1: ARL EQUINOX 100 X-ray diffractometer.



The ARL EQUINOX 100 provides very fast data collection times compared to other conventional diffractometers thanks to its unique curved position sensitive detector (CPS) that measures all diffraction peaks simultaneously and in real time. It is therefore well suited for both reflection and transmission measurements (c.f. Figure 1).

For XRD measurements, sheet samples of PE (Polyethylene) and PP (Polypropylene) were measured in transmission geometry for 5 min under Cu-K α radiation. The quality of the data obtained with benchtop ARL EQUINOX 100 is comparable to data from a typical high-power floor standing instrument. Qualitative analysis was carried out using MDI JADE 2010 with the ICDD PDF4+ Organic database.

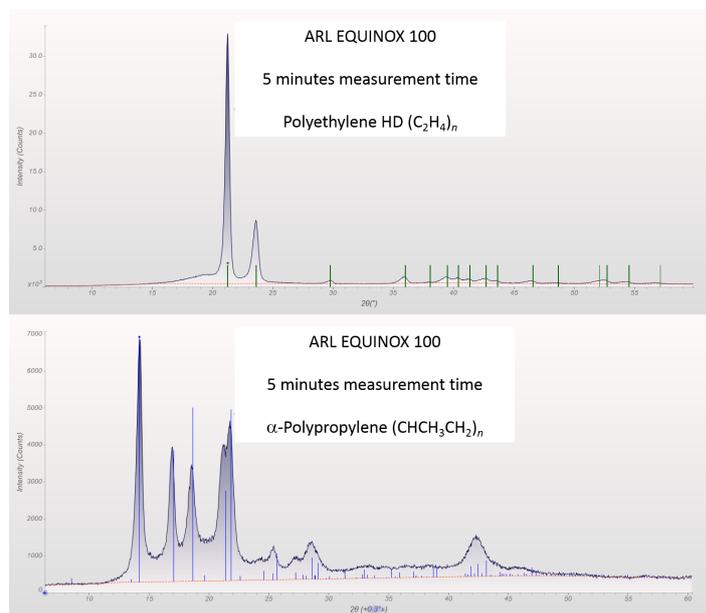
Results

Comparing the data to ICDD PDF4+ Organic database clearly yields high density Polyethylene (HD PE) and Isotactic Polypropylene as results. (c.f. Figure 2).

Conclusion

The ARL EQUINOX 100 benchtop instrument in combination with the MDI JADE 2010 software suite and ICDD pdf4+ Organic database is a quick screening solution to conveniently determine the structure and type of polymer materials within short time.

Figure 2: Diffraction patterns of HD PE (top; 5 min measurement time) and α -PP (bottom; 5 min measurement time)



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