



橋 THE BRIDGE

MATERIALS ANALYSIS
eNEWSLETTER

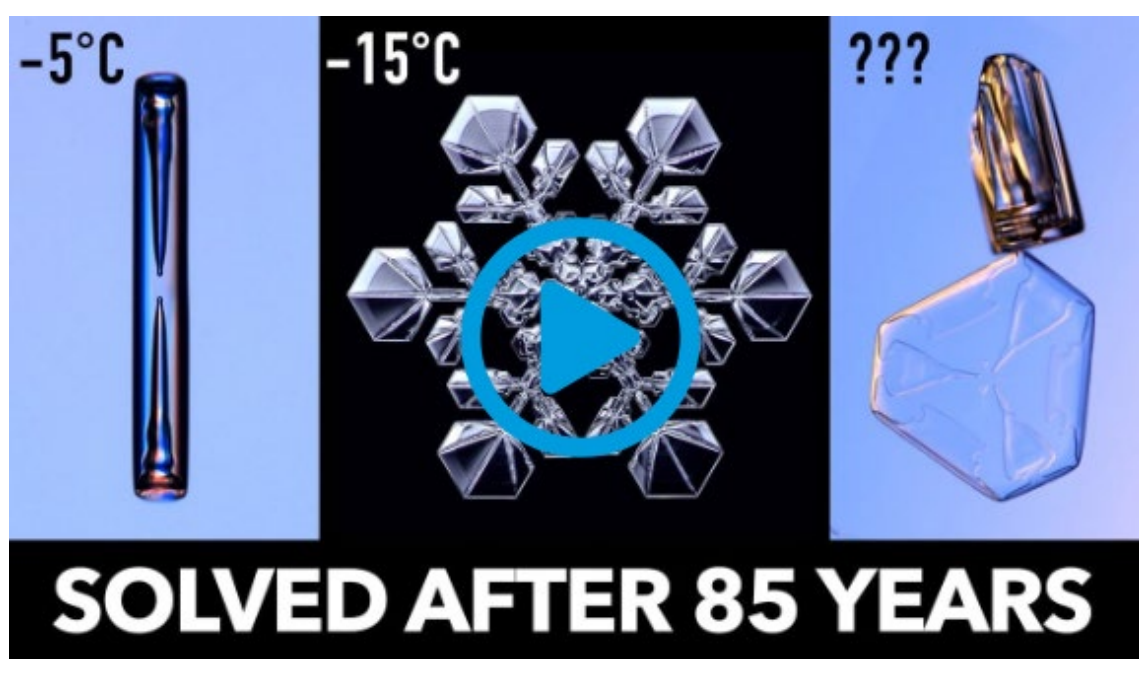
DECEMBER 2021, ISSUE 102

WELCOME

In a celebration of winter, we include an interesting video concerning the physics of snowflake creation. Anyone involved in technology probably has a fascination with snowflakes, why they are all different and how they maintain symmetry throughout the crystallization process. Snowflakes fall with a fascinating variety of shapes and patterns, including stellar dendrites, hollow columns, triangular crystals, and many more. Stellar dendrites are the most recognizable snow crystals. Their name comes from their star-shaped appearance, along with their branches and side branches ("dendrite" means tree-like). But the other shapes are also interesting, and the variety of shapes can be tied to the temperature and humidity present during formation. Watch the video below and you will have a much better understanding of the science behind the formation of snowflakes.

This month we have also included a variety of application notes covering quality control of gasoline, utilizing XRD and GI-WAXS to characterize thin film materials, and quantitative analysis of Portland cement by the pressed pellet method according to ASTM C114-18. Finally, we present a real-life story about the use of handheld Raman instruments to help curtail the flow of illicit drug starting materials into the epicenter of the Asian drug trade.

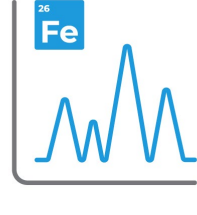
VIDEO OF THE MONTH



The Snowflake Mystery

Dr. Ken Libbrecht is the world expert on snowflakes, designer of custom snowflakes, and snowflake consultant for the movie *Frozen*. His photos appear on postage stamps all over the world. His website, <http://snowcrystals.com>, is full of information about snowflakes.

FEATURED APPLICATION NOTES



EDXRF

Mn in Gasoline by ASTM D5059 Part D

Applied Rigaku Technologies

The analysis of manganese (Mn) in MoGas (motor gasoline) and AvGas (aviation gasoline) is demonstrated as per ASTM D5059 Part D XRF using Cartesian Geometry EDXRF. Methylcyclopentadienyl manganese tricarbonyl (called MMT or MCMT) is an anti-knock agent added to MoGas and AvGas to boost octane rating, replacing tetraethyl lead in many regions of the world. In motor gasoline, the Mn content is typically between 50–500 mg/kg and can be as high as 3000 mg/kg (approximately 3 g/L) in AvGas. Reliably characterizing the Mn content of gasoline ensures optimum engine performance based on the engine's compression ratio and other geometrical and mechanical operating conditions. To meet the needs of the industry, Rigaku offers simple and versatile benchtop EDXRF analyzers for the analysis of manganese in gasoline. For optimum results in the ultra-low range, [NEX CG II](#) achieves exceptional detection limits using Cartesian Geometry EDXRF.

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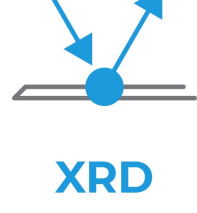
XRD

Quantitative Characterization of Polymer Film by Orientation Function

Rigaku Corporation

Polymers are generally long-chained semi-crystalline materials. They are made up of long, carbon chain structures that can be analyzed by XRD. XRD can determine the identity of the polymer, degree of crystallinity, crystallite size and crystallite orientation. An important property of polymer films is their ability to stretch. This property can be influenced by thermal treatments and forming processes. By evaluating the crystal orientation focusing specifically on the *c*-axis and the degree of the orientation, the yield stress and strain ("stretchiness") of polymer films can be predicted. The beta scan in the transmission $\theta/2\theta$ arrangement is commonly used as a method to evaluate the orientation. Analysis using a whole pole figure which is obtained from reflection and transmission pole figure measurement allows you to understand the degree of orientation in more detail. Furthermore, it is possible to evaluate the orientation distribution quantitatively by using Herman's orientation function, which is calculated from the whole pole figure.

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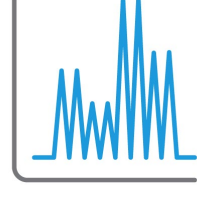
XRD

Observation of Orientation State of Polypropylene Film Products by 2D-GI-WAXS Measurement

Rigaku Corporation

The grazing-incidence wide-angle X-ray scattering (GI-WAXS) technique is often employed for the measurement of ultrathin film specimens since their very weak signals can be effectively observed. GI-WAXS can be applied to materials that cannot be evaluated by transmission WAXS, such as thin film on a substrate or a polymer film with metal deposition on the back surface. The combination of a 2D-SAXS/WAXS attachment with an aperture slit and a 2D detector allows the acquisition of clearly resolved 2D diffracted images by a general X-ray diffractometer with a line-shaped incident beam.

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WDXRF

Cement Analysis by the Pressed Powder Method on the ZSX Primus III+ According to ASTM C114-18

Rigaku Corporation

Cement is one of the most important materials for construction. Many kinds of hydraulic cements, including Portland cement, with various physical properties are produced by changing the composition of clinker minerals; therefore, it is important to control the chemical composition of cement products and interim products.

ASTM C114-18 covers chemical analysis of hydraulic cement. In this standard, mainly wet chemical analysis procedures are described and X-ray fluorescence (XRF) spectrometry is mentioned as an example of "Rapid Test Methods." In practice, XRF spectrometry has been used for chemical composition analysis of cement owing to its simple sample preparation and high precision.

This application note demonstrates quantitative analysis of Portland cement by the pressed pellet method according to ASTM C114-18 on Rigaku ZSX Primus III+, a sequential wavelength dispersive XRF spectrometer.

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MATERIALS ANALYSIS IN THE NEWS

Handheld Raman in Action



Rigaku's ResQ CQL chemical analyzer is used to identify narcotics and disrupt the chemical supply. (Rigaku Analytical Devices)

[Police1.com](#) recently sat down with [Michael W. Brown](#) (Global Director of Counter-Narcotics Interdiction Partnerships for Rigaku Analytical Devices) to discuss ways Rigaku is helping domestic and international law enforcement agencies degrade Transnational Organized Crime groups.

Read more about Rigaku's Operation HOPLON's mission to disrupt the flow and movement of precursors used to manufacture narcotics by implementing technology, training, and support.

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