Industry Case Study

Brigg Renewable Energy Plant

Compositional analysis of solid residues from biomass combustion process

Challenge

Brigg Renewable Energy Plant (BREP) is a power plant producing renewable energy using combustion of biomass. The process generates solid residues which can build-up during combustion and cause blockages, ultimately resulting in unplanned shutdowns. Over time this can lead to loss of revenue due to reduced energy output.

Bridge scientists worked with BREP to identify the composition of the residues, to enable informed decisions to be taken in the implementation of remedial measures.

Approach

Bridge scientists employed a range of advanced materials analysis techniques to probe the samples of residue derived from different stages of post-combustion processing.

Powder X-ray diffraction (PXRD) is a technique that can be used to analyse a wide range of crystalline solid materials, from minerals to complex organic compounds

(Figure 1). In this case, PXRD was utilised to assess the overall crystallinity of the residue samples, and to provide accurate identification of the crystalline mineral phases present. The PXRD instrument at the Bridge (Figure 1) is additionally equipped with advanced capabilities which allowed measurements to be conducted under controlled temperature and humidity conditions to ensure consistency across measurements.

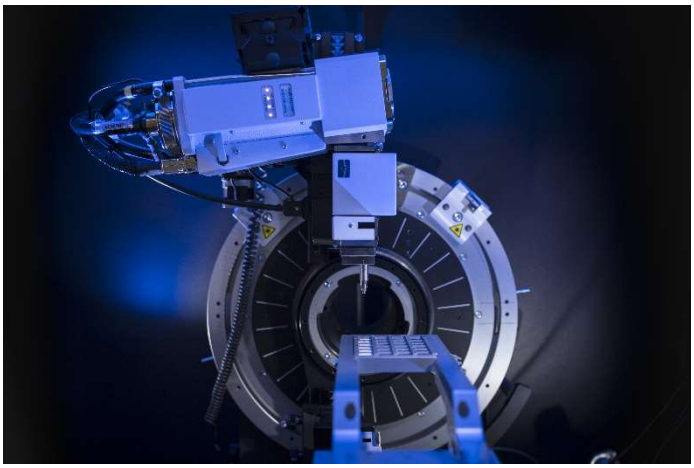

Figure 1. *Bruker D8 powder X-Ray diffraction instrument at the Bridge.*

X-Ray fluorescence (XRF) and Fourier-transform infrared (FTIR) spectroscopy analysis were also undertaken on the samples to support the PXRD data and to provide insight into the non-crystalline components of the residues.

Outcomes

Using XRF we were able to determine the elemental composition of the sample whilst FTIR provided information on organic components within the residues.

PXRD was then able to interrogate the crystalline mineralogy of the sample, allowing further identification of the sample constituents. An example PXRD result is shown in Figure 2, illustrating the precise matches between the experimental results and the database patterns of the identified components.

Taken together, the use of these complementary advanced analytical techniques allowed the Bridge to provide the client with detailed compositional knowledge of the residual build-up from the combustion process. In turn, this knowledge has allowed BREP to take informed steps in the prevention of residue build-up in the future.

Summary

A wide range of advanced analytical instrumentation, together with a dedicated project delivery resource including instrument specialists, is available for the benefit of Bridge clients and collaborators. This case study illustrates the advantages of this through the employment of multiple analytical techniques for comprehensive material characterisation, furthering knowledge and understanding of industrial processes to drive process and product improvement.

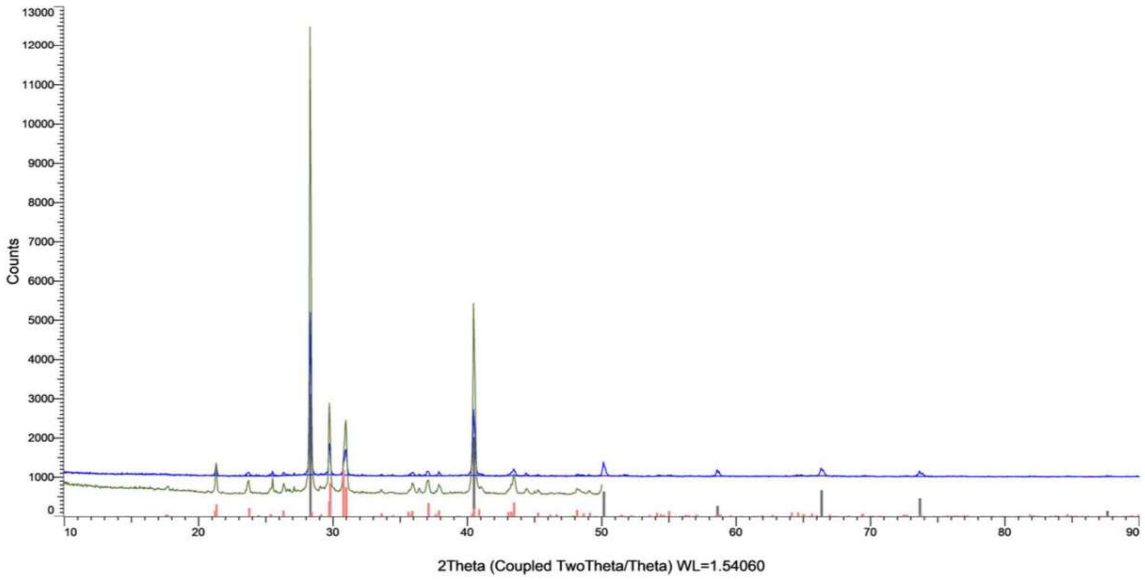

Figure 2. *PXRD data from one residue – blue and green lines are the sample measurements; red and black lines are reference patterns of the identified mineral components.*

Bridge

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