Anton Paar

Fueling the Future: How Sheffield University's Energy Innovation Centre is Accelerating Sustainable Aviation with Anton Paar Technology

Customer Success Story

→ Ian Gregory, from Anton Paar, trains laboratory manager Hansini Rathnayake Mudiyanselage on how to use Anton Paar's SVM 3001 viscometer.

Located in the heart of the University of Sheffield's Innovation District, the Energy Innovation Centre (EIC) stands as one of Europe's leading R&D hubs for low- and zero-carbon technologies. Within its state-of-the-art laboratories, a dedicated team of researchers is working at the cutting edge of sustainable aviation fuel (SAF) development, supported by the precision and reliability of Anton Paar instrumentation.

The challenge is clear: aviation, one of the most carbon-intensive sectors, must transform. The solution? A new generation of SAFs. At the EIC, a highly skilled team—including Senior Research Fellow Dr. Ehsan Alborzi, Laboratory Manager Hansini Rathnayake Mudiyanselage, and Operations Manager David Gains—is partnering with industrial innovators to bring this vision to life. But ensuring new fuels are safe, stable, and ready for the skies requires testing technologies that can meet the highest standards of accuracy, repeatability, and efficiency.

World-class facilities, complex demands

Certified to ISO 9001 standards, the EIC offers a unique blend of academic expertise and advanced fuel analysis capabilities. Their laboratory is one of the few worldwide capable of conducting simultaneous, multi-parameter analysis on aviation fuels – even under extreme conditions such as -40 °C viscosity testing.

However, working with volatile, flammable fuel samples brings complex technical and safety challenges. As Hansini notes, "Achieving the accuracy of standard methods and deriving better precision from validated methods is not possible without the right resources in place."

→ Hansini Rathnayake Mudiyanselage, Laboratory Manager at the Sheffield University Energy Innovation Centre, uses an Anton Paar Diana 700.

Anton Paar's suite of instruments has become essential to meeting this challenge head-on. Whether for validating new SAF formulations or supporting collaborative R&D with major partners, these devices have enabled EIC to deliver faster, more precise results with fewer delays and greater operator safety.

Precision instruments for a high-stakes mission
Among the critical tools in EIC's laboratory are:

- → **DSA 5000 M density and sound velocity meter**
  Used to determine fuel density, a key parameter affecting aircraft weight and range. This instrument ensures temperature stability during testing, helping maintain compliance with strict aviation standards.
- → **SVM 3001 viscometer**
  Viscosity testing at sub-zero temperatures is notoriously difficult, yet essential for evaluating SAFs. The SVM 3001 simplifies this process with built-in validation methods aligned to ASTM standards.
- → **PMA 500 flash point tester**
  Flash point testing of low-volatility samples poses a fire risk. The PMA 500's integrated fire suppression and detection systems significantly enhance lab safety.
- → **Diana 700 distillation unit**
  The Diana 700 automates precise volume measurements for distillation analysis, removing the guesswork and minimizing operator variability.
- → **RapidOxy 100 oxidative stability tester**
  This system plays a pivotal role in evaluating the oxidation stability of SAFs. Its ability to accelerate long-term ageing scenarios – from 10,000 hours down to 200 – makes it invaluable for both research and quality control.

Driving innovation in research and education
One of the key users of the RapidOxy 100 is Rahima Babayeva, a fourth-year Engineering Doctorate (EngD) student at the University of Sheffield. Sponsored by EPSRC and Rolls-Royce, her research focuses on the effects of chemical changes in SAFs on jet engine infrastructure.

"The RapidOxy 100 is essential to my work," says Rahima. "It allows me to

replicate years of fuel ageing in just a matter of days. Without it, I would have had to design and build a custom rig – something that could have taken years."

Rahima uses the instrument in both liquid and solid phase research. In the liquid phase, she stresses fuels at controlled temperatures and analyses them with Two Dimensional Gas Chromatography (GCxGC). For the solid phase, she studies surface deposition on stainless steel samples, later analyzing them with Orbitrap Secondary Ion Mass Spectrometry (Orbisims).

The insights she's gained have made a major impact – not just in the lab, but on the global stage. At IASH 2024 in Kentucky, her images of surface deposits generated using the RapidOxy 100 drew widespread interest. She also had the opportunity to discuss her findings at COP29 in Azerbaijan.

"The most helpful features are the intuitive touchscreen and the ability to export data with ease," she adds. "It's very user-friendly and safe, which is critical when running extended experiments."

Building resilience and speeding discovery

Anton Paar instruments have helped EIC overcome several common bottlenecks in experimental workflows. From delays caused by equipment breakdowns to inconsistencies in sample preparation, automation and digital monitoring features have made a noticeable difference. As Hansini explains, "We are now able to measure multiple material properties simultaneously. These are relatively small pieces of equipment, but they help us deliver major projects. They're accurate, user-friendly, and safe."

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Hansini Rathnayake Mudiyanselage, Laboratory Manager, Energy Innovation Centre

Additionally, the laboratory has greatly benefited from Anton Paar's long-standing customer service commitment. Over the last decade, the partnership has grown into a dependable collaboration. "Their responsiveness and expertise have played a crucial role in our projects," says Ehsan. "That's why Anton Paar was invited to participate in several tenders when we expanded the lab in 2021."

Maintenance and calibration services are another key factor. Preventive maintenance keeps instruments in top condition, while calibration with ISO 17034-certified reference materials ensures that test results meet the highest standards of accuracy and traceability.

A platform for the future of flight

The Energy Innovation Centre continues to expand its capabilities. Today, it supports fuel readiness levels 1–3 and is building infrastructure to predict fuel properties based on chemical composition. This is essential not only for validating SAFs, but also for integrating them into existing jet engine systems.

"We're able to focus more on advanced analysis, like 2D gas chromatography, because the Anton Paar instruments handle the core physical property measurements so reliably," says David Gains. "They've allowed us to streamline our workflow and allocate more time to high-level problem solving."

Ultimately, this accelerates the path to SAF certification, reducing both development time and cost for industry partners.

Empowering a greener aviation sector

In a sector where safety, reliability, and innovation converge, the collaboration between the EIC and Anton Paar is a powerful example of how the right tools and partnerships can drive real progress. From empowering doctoral research to advancing national and international projects, Anton Paar instrumentation is playing a vital role in the global transition to sustainable aviation.

Rahima summarizes it best: "Without the RapidOxy 100, I couldn't imagine my PhD research. It's an incredibly powerful tool – and I would wholeheartedly recommend it to any lab working in this space."

→ At IASH 2024 in Kentucky, University of Sheffield PhD candidate Rahima Babayeva presents images of surface deposits generated using Anton Paar's RapidOxy 100.

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Rahima Babayeva,
EngD Researcher,
University of Sheffield

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www.anton-paar.com/apb-instruments

Instruments DSA 5000 M, SVM 3001, PMA 500, RapidOxy 100, Diana 700

Measured parameters density, kinematic viscosity, flash point, oxidation stability, distillation range analysis

Samples fuels