

Driving Materials Innovation at WMG

University of Warwick

At the intersection of cutting-edge materials science and real-world industrial application, Dr. Carl Slater, Associate Professor at Warwick Manufacturing Group (WMG), University of Warwick, is leading pioneering research that connects fundamental metallurgy with next-generation steel production. As manager of the Hot Works Lab and a core member of the [Advanced Steels Processing Group](#), Dr. Slater is redefining alloy development and process optimization, powered by the versatility and precision of the Gleeble system.

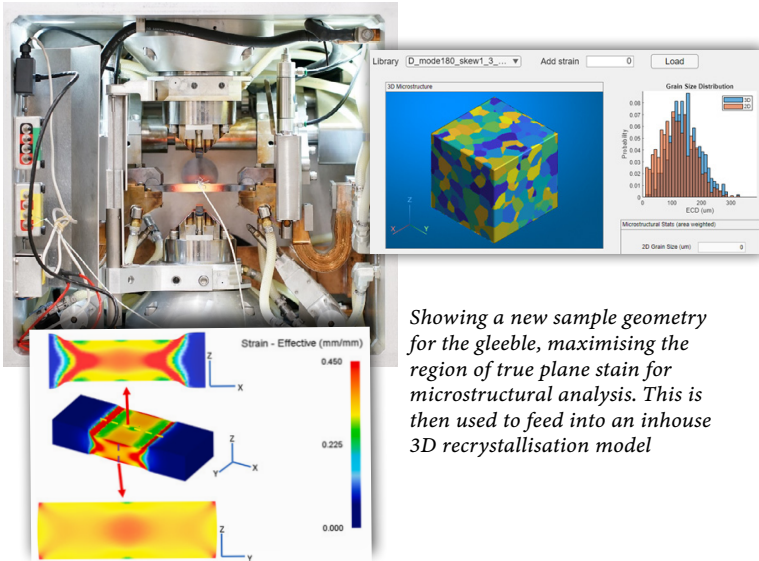
About WMG and its Mission

Warwick Manufacturing Group (WMG) is the largest academic department at the University of Warwick and a part of the UK's Catapult Network; it's one of six [High Value Manufacturing Catapult Centres](#), which were established to help commercialise high-potential innovations and accelerate technology readiness for industrial adoption.

While Dr. Slater and his team specialize primarily in steel — covering alloy design, optimisation, testing, and fundamental metallurgy — they routinely expand into a variety of materials, including nickel superalloys, titanium, copper, rubber, and solders. Their collaborative reach spans industries, including aerospace, automotive, nuclear, agriculture, packaging, and construction, making WMG a vital player in applied materials research.



Dr. Carl Slater with WMG's Gleeble HDS-V40



Showing a new sample geometry for the gleeble, maximising the region of true plane strain for microstructural analysis. This is then used to feed into an inhouse 3D recrystallisation model

From Core Equipment to Career Catalyst

For Dr. Slater, the Gleeble system isn't just a lab tool; it's been a mainstay throughout his career. "I've been using Gleeble for nearly 20 years. It's hard to remember a time when it wasn't central to my work," says Dr. Slater. "Once you've seen what it can do, its control, flexibility, and the depth of insight it provides, it's nearly impossible to go back to conventional methods."

At WMG, the Gleeble sits at the heart of the Rapid Alloy Production (RAP) suite, a pipeline for casting, rolling, and processing novel alloys. After casting and rough rolling, materials are transformed into Gleeble-compatible samples. The system is then used to simulate thermomechanical processing paths with extreme precision, helping researchers understand microstructural evolution in real-time.

The ability to "freeze" microstructures mid-process through the Gleeble's proportional water quench features enables Dr. Slater and his team to build rich, in-house microstructural models, resulting in predictive alloy design.

Standardizing Quality, Enabling Confidence

The Gleeble's greatest strength, according to Dr. Slater, is not speed, but repeatability and control.

"The Gleeble isn't about saving time. It's about building confidence," he explains. "The system has enabled us to create standardised methods that collaborators can follow with high fidelity. When we see performance changes, we know they're real, not artifacts of inconsistent testing." Over time, this consistency has laid the foundation for meaningful collaboration, not just within WMG, but across the UK and internationally.

Dr. Slater continues: "Warwick houses around a quarter of all UK Gleeble systems, including one of 3 active HDS-V40 worldwide. That means we're often the place other universities turn to when they're struggling with a test. And globally, researchers want to work with us because we've built up such deep expertise with this specific machine."

Pushing Boundaries, One Sample at a Time

For Dr. Slater, innovation means pushing the limits of the Gleeble: "If I'm not breaking it, I'm not pushing it hard enough," he chuckles. From plane strain deformation with water quenching to adapting the system for non-traditional materials, the Hot Works Lab continually tests what's possible. Each year, the team uses the Gleeble in new and unexpected ways, whether it's validating a recycled alloy concept, replicating high-strain industrial forming, or stress testing new sample geometries. Dr. Slater likens the system to a Swiss Army knife: you don't know all the ways you'll use it until it's in your hands.

Smart Alloy Processing and Real-World Impact

One of the most exciting areas of development is what Dr. Slater calls “smart alloy processing.” By integrating processing simulations, alloy composition data, and performance targets, the team is working toward a future where optimal thermomechanical paths are generated automatically before being validated on the Gleeble.

“We’re creating a system where you input a composition and processing tolerances, and the Gleeble helps determine the ideal grain size or mechanical profile,” says Dr. Slater. “This kind of integrated intelligence has huge implications for how fast we can move from concept to production.”

And the results speak for themselves. In a recent aerospace-grade alloy development project, the RAP suite, including the Gleeble, enabled the team to:

- Design and test 14 new alloy candidates
- Downselect to a single optimised composition
- Facilitate industrial-scale casting and deployment within just a few months

This accelerated timeline represents a dramatic reduction from the traditional 18-month cycle typical of industry.



Dr. Carl Slater with lead Gleeble technician Edward Hodierna

Career-Defining Opportunities Through Equipment Mastery

The impact of the Gleeble on Dr. Slater’s work goes beyond research outputs. It’s shaped his career trajectory, leadership roles, and academic recognition.

Dr. Slater explains: “I joined WMG in 2014, just as we were purchasing a new Gleeble and designing the Advanced Steel Research Centre. Because of the system’s unique infrastructure requirements, I became part of the building’s design team and eventually the academic lead. When the centre opened in 2017, it became one of the proudest achievements of my career.”

Becoming a proficient Gleeble user also opened unexpected doors. “It has made me the go-to person for complex processing questions. That visibility and trust led to collaborations, grants, and ultimately my role as head of Rapid Alloy Processing.”

Final Thoughts: More Than a Machine

Looking ahead, Dr. Slater’s focus is on maintaining momentum, continuing to push boundaries, and supporting collaborators with reliable, high-quality data. “People often ask how my research influenced how I use the Gleeble. But really, it’s the other way around; the Gleeble shaped my research, my lab, and my career.”

He concludes with a sentiment that reflects the heart of innovation: “Having a Gleeble forces you to say ‘yes’ to hard problems. It encourages flexibility, creativity, and resilience. I’m 100% sure I wouldn’t be where I am today without it, and for that, I’ll be forever grateful.”

At WMG, the Gleeble is more than a research instrument; it’s a catalyst for discovery, collaboration, and career-defining breakthroughs. In Dr. Slater’s hands, it bridges the gap between theory and industrial reality, enabling rapid, reliable, and repeatable insights that shape the future of materials engineering.

As the boundaries of alloy development continue to expand, the Gleeble remains at the core of WMG’s mission: turning bold ideas into tangible innovations that strengthen industries, accelerate progress, and inspire the next generation of materials scientists.



Gleeble HDS-V40