



PhD position in HYDROCEM— Hydrogels directing cement hydrates for engineered high-tensile cementitious binders

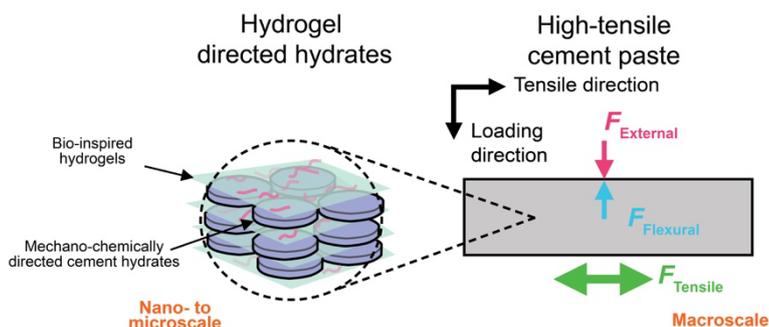
Closing date: May 10 2026

Applications are invited for a fully funded PhD studentship to work on HYDROCEM, funded by the Research Ireland Pathway Programme and supervised by Dr Damian Palin in the School of Engineering at Trinity College Dublin, The University of Dublin (TCD).

The studentship will start in September 1, 2026 and will cover fees (full overseas rate) and stipend for up to four years.

Dr Damian Palin's group blurs the boundaries between materials science and biology creating innovative bio-enabled and informed engineered materials to enhance human well-being. As part of this work, the group has developed hydrogel systems for the chemical and mechanical control of crystal form and organisation [e.g., 1–2] and introduced a linear-elastic fracture mechanics model to describe crystal growth in structured hydrogels [1].

Schematic overview of HYDROCEM



HYDROCEM will add designer hydrogels

to cement binders (that bind cementitious materials together) to instruct their formation and organisation at sub-millimetre scales to enhance their tensile strength, promising cementitious materials that meet structural demands with significantly less cement, towards more sustainable construction. Key research aims you will contribute to: (i) **Mechanical control**—use structured hydrogels to direct cement hydrate formation and create predictable hydrate–hydrogel composites; (ii) **Chemical control**—use soluble polymers with systematically varied charge/charge density to tune hydrate morphology and polymer–hydrate binding; and (iii) **Composite engineering**—integrate selected gels (e.g., sheets/fibres), including functional double-network systems, into cementitious binders to instruct paste architecture and improve mechanical performance.

The successful candidate will: have access to world-class materials development facilities; engage with leading international and academic project collaborators: Prof. Daniel Kelly at TCD, Assoc. Prof. Niels Holten-Andersen at Lehigh University, and Dr Jure Zlopasa at International Flavors & Fragrances (IFF); and undergo secondments at Lehigh University and IFF.

Applicants should hold a primary degree (and ideally a Master's) in civil engineering, materials science, chemistry, or a closely related discipline. Enthusiasm to learn **cement and polymer chemistry, advanced characterisation and modelling**, and to work **both independently and collaboratively across disciplines** is essential; prior experience in any of these areas is advantageous.

To apply, email to Dr Damian Palin: damianpalin@gmail.com before **23:59 (Irish time), May 10, 2026**, with the subject line HYDROCEM_PhD_[your full name]: (1) a CV (including education, research experience, relevant skills, publications and presentations); (2) a one-page statement outlining your motivation, understanding of the topic, and relevant experience/ideas; (3) academic transcripts (unofficial acceptable at first stage); (4) contact details of two referees; (5) a writing sample (e.g., a published paper, thesis excerpt, or report). Shortlisted candidates will be invited to interview in June. If selected, you will then be supported through the formal TCD application process to start **September 1** (flexible by agreement).

References

- [1] D. Palin, R. W. Style, J. Zlopasa, J. J. Petrozzini, M. Pfeifer, H. M. Jonkers, E. R. Dufresne, L. A. Estroff, Calcite Crystallites Grown in an Anisotropic Gel: Assessing the Physical Effect of Gel Structure on Crystal Form, *Journal of the American Chemical Society*, 2021, 9, 3439-3447.
- [2] D. Palin, M. P. Chang, J. A. Kunitake, S. Sutter, L. A. Estroff, Bioinspired chemo-mechanical control of calcium carbonate crystal growth, *Journal of Crystal Growth*, 2023, 602, 126943.