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EPFL Valais/Wallis SEMINAR

30. 5. 2022, 11:15 - 12:00, EPFL Valais/Wallis in Sion, ZOOM

A Brief Resumé of Renewable Energy-Related Experiences in Indiana, Norway, & Denmark

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The academic and professional achievements which relate to my profile as a potential doctoral candidate will be presented. Particularly, the details of my self-designed MSc thesis project being completed at Hempel A/S ("The Effect of Filler on Coating Acoustic Properties and Leading-Edge Protective Coating Lifetime") will be elaborated. The dramatic difference in performance of different coating filler particles with respect to Rain Erosion Testing (RET) is shown. Coatings' longitudinal wave speed and pressure wave attenuation are measured using pulse-echo ultrasound at 25 MHz, and an oscillatory rheometer is used for mechanical characterization. The discrepancy in coating performance is attributable to multiple factors including the peak compressive stress experienced by the coating surface as a result of raindrop impacts, the pressure dependent shear modulus of the coatings, and solid compressive strengths. Peak stresses are calculated by applying shockwave theory, and it is proposed that the failure mechanism of wind turbine blade leading-edge protective coatings is a polymer fatigue mechanism. The filler particles examined are crushed barite, quartz, corundum, hematite, and marble (all ~3 µm diameter) including one coating formulation which contains no filler particles. This correlation of cheap, quick characterization test methods with the expensive RET is small yet impactful progress towards accelerating the development of effective wind turbine protective coatings.

CV: Thomas Michel Carpenter

Born in 1996 in Bloomington, IN, USA, Thomas graduated with a B.Sc. in Chemical Engineering from Purdue University in West Lafayette, IN, USA in 2018. An independent study through the Fulbright Program in led him to Scandinavia. And, despite the program being cut short due to COVID-19, he remained in the region by starting a M.Sc. in Chemical & Biochemical Engineering at The Technical University of Denmark in Copenhagen the following academic year. In his M.Sc., Thomas continued to focus on renewable energy-related subjects with a particular focus on protective coatings for wind turbine blades. After a summer internship with Hempel A/S, a global leader in coatings production, Thomas designed an extracurricular project investigating the effect of filler particles on wind turbine coating performance which led to the expanded study which is his current M.Sc. thesis project.