Advanced Modelling of Aluminium Alloys and Digital Manufacturing in Norsk Hydro

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Digital twins are a key enabler of Industry 4.0, driving the digital transformation of manufacturing. This lecture demonstrates the application of a specialized digital twin for the design and production of aluminum extruded products. The twin integrates high-precision, physics-based models to predict microstructural evolution across the entire process chain—from as-cast structure and homogenization to extrusion and age hardening. Special emphasis is placed on products made from post-consumer scrap, where broader chemical composition ranges affect processability and properties. The digital twin optimizes process parameters to ensure final properties remain within tolerance limits. Examples will also highlight its role in planning and pre-production, where cost and CO_2 emissions are minimized alongside technical performance.