

## A **SUCCESS** STORY

### **NANOSTRUCTURED MULTIFUNCTIONAL COATINGS** THAT RESIST VALVE CORROSION AND AIRCRAFT ENGINE EROSION, ALONG WITH SCRATCHING AND GLARING IN OPHTHALMIC SOFT OPTICS AND SMART LENSES

Prof. Ludvik Martinu at Polytechnique Montréal, along with four industrial partners (Essilor, Guardian Industries Corp., Velan Inc., and Pratt & Whitney Canada), has developed advanced optical coatings, along with advanced tribological protective coatings. Their objectives were to contribute to Phase 2 of the **Natural Sciences and Engineering Research Council (NSERC) Multisectorial Industrial Research Chair in Coatings and Surface Engineering (MIC-CSE)**. Their sectors of interest include optics, energy, manufacturing and aerospace.

This collaboration between industrial partners proved a successful one. **Essilor** conducted research into optical coating systems for anti-reflective and scratch-resistant ophthalmic applications without long-term cracking. It succeeded in improving high-performance organic-inorganic hybrid coatings, which now provide greater stability and durability at high temperatures. **Guardian Industries** sought to improve advanced optical coatings with functional tribomechanical and low-emissivity properties, along with intelligent coatings for architectural glass. The company was also able to develop smart windows with advanced optics, along with new features like custom colouring for the optical properties. The company intends to manufacture nanoparticle-based glass on a larger scale.

For its part, **Velan** sought to improve industrial valve protection through high-performance surface treatments, providing wear and corrosion resistance, along with long-term durability for the gas industry's harsh environments. The collaboration helped the company to develop three new technologies to meet its objectives. Meanwhile, **P&W** sought to resolve a set of technological challenges specific to multifunctional protective coatings in an effort to improve aircraft engine durability. The company developed no less than five applications to address the wear and tear resistance of aerospace components using hard, invisible protective coatings.

In total, seven patents were granted and three were filed by Polytechnique Montréal, Essilor, Guardian Industries, Velan, and P&W. Two students were hired by partner companies. Both received a bonus for excellence in research from the NSERC, thus extending the research project by another five years [2022-2027].

 *Our collaboration with Prof. Ludvik Martinu's MIC-CSE chair helped us better understand the link between manufacturing processes and the optical and mechanical performance of our ophthalmic coatings. Thanks to the skills of internationally renowned researchers, we are currently developing new materials and integrating them into innovative structures to create new properties for spectacle lenses while improving vision and comfort for the planet's citizens. We greatly appreciate PRIMA Québec's support and guidance, all of which benefited our activities.* 

- **Hélène Maury, PhD,**  
Technical Leader,  
Light Management –  
Essilor Research & Development

# A SUCCESS STORY

(CONTINUED)



« *PRIMA Québec's funding, combined with the expertise provided by the Laboratoire des Revêtements Fonctionnels et d'Ingénierie de Surfaces (LaRFIS), led by Prof. Ludvik Martinu at Polytechnique Montréal, helped Guardian Glass go beyond its current understanding of the materials and processes at the heart of its products. The knowledge that was acquired helped improve the performance of low-emissivity glass products, which can directly impact the energy consumed by our built environment.* »

- **Dr. Richard Vernhes**,  
Industrial Scientist -  
Guardian Industries Corp.

« *Among other things, the expertise behind Prof. Ludvik Martinu's chair in material characterization and tribology helped us fully grasp a recurring failure mode within our industry, caused by the high-temperature aging of hard materials, while developing a solution that we subsequently industrialized and commercialized. We are now positioned as a leader in this niche, and we could not have done it without them.* »

- **Luc Vernhes**,  
Director Engineering,  
Business Development - VELAN

« *Throughout the chair, the combined expertise and innovative thinking of Professors Martinu and Sapieha, along with that of their students, resulted in impressive advances in coating technology for gas turbine engines. The new approach, which brings together members from a wide range of sectors, led to an unexpected cross-pollination of ideas, along with new solutions to old problems. PRIMA Québec's funding allowed the group to secure the specialized equipment and highly qualified personnel required to push the frontiers of science while properly setting up technological solutions for downstream expansion and industrialization activities.* »

- **Joël Larose**,  
Project Engineer,  
Research & Technology,  
Materials & Coatings  
Technology Manager -  
Pratt & Whitney Canada



#### SECTORS

Surface treatment  
Advanced nanostructured material development



#### APPLICATIONS

Energy  
Infrastructure  
Health  
Transport



#### TRL

1-3



#### DURATION

36 months  
(2017-2020)