Project Awarded by the Technology Agency of the Czech Republic in 2017 for Originality of Solution

The project awarded the Technology Agency of the Czech Republic Prize in 2017 in the category of originality of solution was titled *"Research and Development of Advanced Thin-Film Elements for Direct Monitoring of Time Variables via Precisely Calibrated Color Change."* The project was conducted by a team from the Faculty of Chemistry at Brno University of Technology, led by Prof. Michal Veselý, in collaboration with the company INVOS, the Institute of Chemical Process Fundamentals of the Czech Academy of Sciences, the Center for Organic Chemistry, and Charles University.

The project received the award for its innovative approach to the design of smart materials capable of simple, optically readable indication of exposure time to light radiation—without the need for power supply or sophisticated measuring devices.

The aim of the project was to create passive time sensors that allow visual monitoring of the effects of UV radiation through an irreversible color change. This color response is precisely calibratable based on exposure time, opening up broad possibilities for practical use—such as in the sterilization of medical materials, monitoring UV degradation of packaging, or in smart monitoring elements in food and pharmaceutical packaging. The combination of photochemistry research and materials engineering led to a solution that is not only technologically original but also easily transferable to practical applications.

The technical foundation of the solution lies in thin layers of nanocrystalline TiO_2, whose surface is modified with photoactive dyes capable of irreversible color change when exposed to UV radiation. The response of these layers is stable against external factors such as humidity or temperature, and it depends not on the instantaneous intensity of radiation, but on the total dose. The color change is governed by diffusion and surface processes, allowing for the creation of precise calibration models for specific applications. The research results, including the layer structure, response kinetics, and experimental validation, were published in the article:
Vesely, M., Dzik, P., Ettler, K., Wertzova, V., Kubac, L., & Kluson, P. (2024). Disposable indicator card for personal monitoring of solar exposure. *Journal of Photochemistry and Photobiology A: Chemistry*, 454, 115741.
https://doi.org/10.1016/j.jphotochem.2024.115741

The awarded project has a clear societal benefit—it offers a simple, robust, and inexpensive tool for monitoring light exposure duration in environments where electronic measuring systems cannot be used. The ability to visually read the exposure time can play an important role in health protection, ensuring proper sterilization processes, quality control in the food and pharmaceutical industries, and also in security packaging technologies. The project's outcomes thus represent a significant example of how basic research can evolve into an innovative product with real-world impact.