

SUCCESS STORY

Investigation of the Properties of Polyurethane Foams by Means of Simultaneous Thermal Analysis and Evolved Gas Analysis

A Success Story of the University Politehnica of Bucharest and NETZSCH-Gerätebau GmbH



The University Politehnica of Bucharest, UPB, is the largest and oldest technical university in the country and among the most prestigious universities in Romania. Creating knowledge mainly by scientific research, giving it out by education and professional training, disseminating it by information technologies as well as using technological innovation are elements defining the university's distinctive profile.

Scientific research at UPB is traditionally one of the most important components of its activities, offering national and international visibility and professional recognition. In connection with the modern concepts of "knowledge society" and "knowledge economy", UPB defined certain strategic orientations of the scientific research, derived from the competencies of our human resources and relied to our research infrastructure.

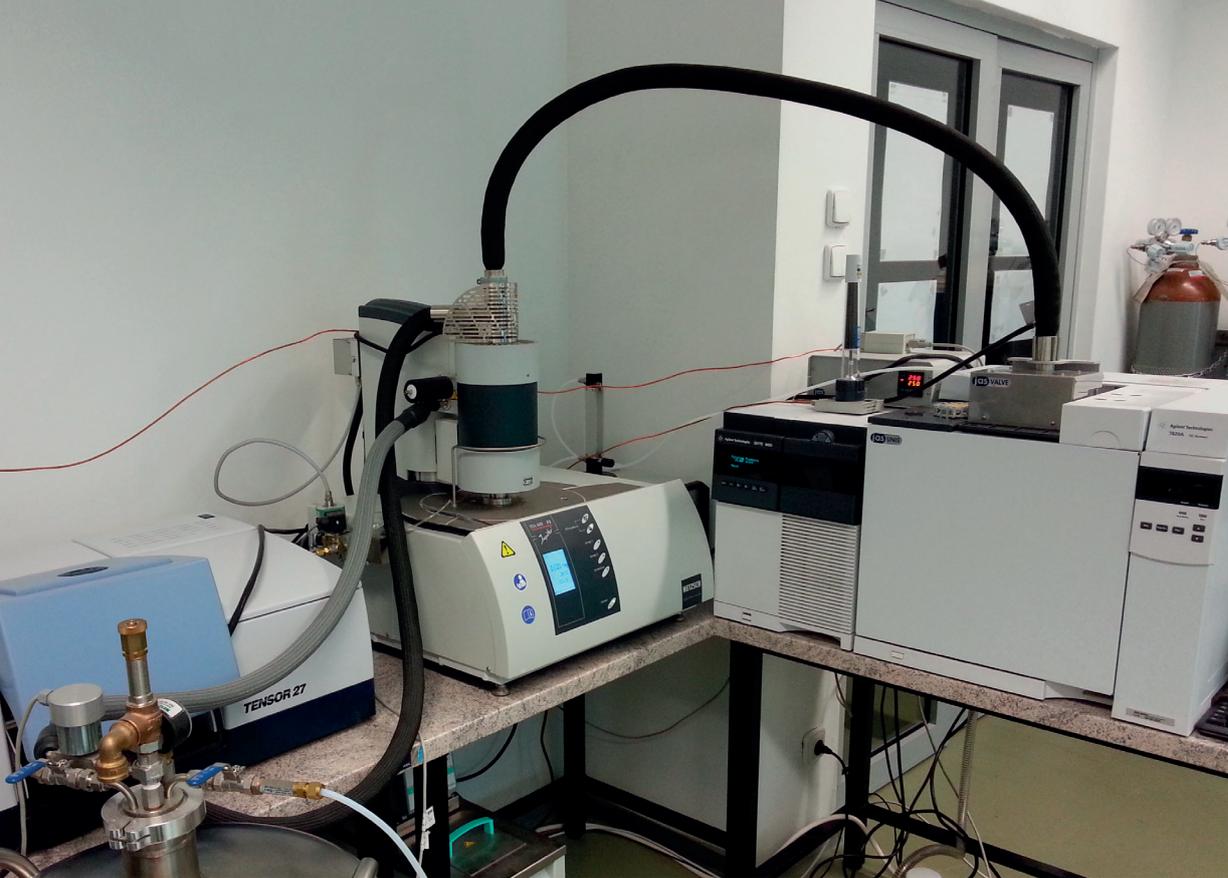
Therefore, research infrastructure plays a key role of UPB's performance and we always try to have the best equipment available. One of my preferred ones is the complex thermal analysis system by NETZSCH: the STA **F3 Jupiter**® TGA/DSC-FT-IR-GCMS. The system is very

versatile and can be used for the entire range of analysis such as metallic compounds, ceramic, glass ceramic, various inorganic compounds, polymeric or composite materials from food packaging, pharmaceutical or industrial applications. Due to its complex coupling with FT-IR and GC MS, it can also analyze gaseous compounds evolved, be it inorganic or organic, and offer valuable information about thermal processes.



Dr. Ovidiu Oprea, University Politehnica, Bucharest, Romania

I was very proud when the device was installed in our laboratory and I was very anxious to start working with it. As I was already using another NETZSCH device, the STA 449 C *Jupiter*®, I had some samples which were waiting to be analyzed with this new system to gain more information about the gases evolved. I knew that by means of the new system, I will be able to identify exactly when a complex compound is losing ammonia or just water, or when combustion gases contain CO, CO₂ or both.



NETZSCH STA 449 C *Jupiter*[®] and STA **F3** *Jupiter*[®] at the University Polytechnica of Bucharest

Unfortunately, one of the first analyses made with this system was related to the “Colectiv” nightclub fire. The number of casualties of this disaster amounted to 64 and more than 100 people were seriously injured. Some firework candles’ sparks ignited the club’s flammable polyurethane acoustic foam, and the fire spread rapidly. The public and the doctors were shocked by the high number of victims and there was no good explanation why people who managed to escape from the fire died after going inside a few more times trying to rescue those left behind. Suspecting that the polyurethane foam combustion gases might be one of the death factors, we have quickly performed a series of tests on some commercially available polyurethane foam samples.

Thermal analysis by means of the NETZSCH STA **F3** *Jupiter*[®] TGA/DSC-FT-IR-GC-MS has quickly revealed the unseen killer in the “Colectiv” nightclub. The gases evolved were a deadly cocktail of compounds, with the main components carbon monoxide (CO) and cyanhydric acid (HCN). Both of them are deadly, even in small doses and kill in silence by impeding the respiratory processes. The results were quickly released to

the public and helped understand that most of the victims were poisoned by toxins released from the burning foam and helped doctors comprehend the complexity of the problem. Also, it explained why so many people acting heroically died. Those who escaped the fire but returned to save a friend or a stranger died a little with every step they made inside, with every breath inside the club, until they never came out again.

With this investigation, we were able to prove that the polyurethane acoustic foams were not flame-retardant and did not comply with fire safety regulations.

Since then, we have used the NETZSCH STA **F3** *Jupiter*[®] STA TGA/DSC-FT-IR-GC-MS system daily for routine measurements such as monitoring the collagen’s water content or essential oils’ release, but also for research projects like the identification of compounds released by polystyrene foam single use plates when come in contact with hot food.

But that’s another success story...

For more information on the Colectiv nightclub fire, go to https://en.wikipedia.org/wiki/Colectiv_nightclub_fire