

## Le Rossignol's Valve

Robert Le Rossignol (1884–1976)

The Columbia political scientist Charles Sayre once explained why academic politics are so vicious. “Because the stakes are so low”, he snarked. Some academic feuds start with an author list. Should one include the former supervisor of the young academic who did the calculations using his ex-boss's code? What about senior Professor whose instrument was used to collect some of the data? And then there's the name order. Who goes first? Who last? Should it be alphabetical? Contrary to Sayre's maxim, for a young academic the stakes could not be higher.

But this short-term focus has a darker side. What does all this matter if your name is completely forgotten a few years later? Such was the fate of Robert Le Rossignol, whose role in the invention of the Haber process has, as the name of the process implies, been totally neglected. “But ... Bosch?” I hear you cry. Even if we call it Haber-Bosch, your “whataboutism” just reinforces the point that the post-doc who did the fundamental experimental work is forgotten; it is only thanks to the historian Deri Sheppard that a real sense of Le Rossignol's contribution has been made clear. Robert Le Rossignol was born in St Helier on Jersey in the Channel Islands. He studied chemistry at UCL which was then led by William Ramsay, a truly outstanding experimental chemist and the discoverer of the noble gases. Although some might sniff that Le Rossignol “only” obtained a second class degree when he graduated in 1905, he had already won the Departmental Prize for experimental excellence in his first year. He was a student who loved to tinker and build stuff, and took a course in “mechanics” in the Engineering faculty. He may also have been inspired by the Heath-Robinson apparatus that Morris Travers had constructed in Ramsay's lab to liquefy hydrogen. By the time he graduated Le Rossignol had published papers in chemical kinetics as well as in organic synthesis, was a probably a dab hand with a lathe and with a glass torch.

In 1906 he moved to Karlsruhe where Fritz Haber's initial experiments with ammonia were in progress. In Le Rossignol, Haber soon realised that he had a very unusual individual, as confident in chemistry as he was in thinking about manifolds and compressors. Within a few months Le Rossignol was Haber's personal assistant. This could not have happened at a more crucial time. A few years earlier some Austrian industrialists, the Margulies brothers, had observed traces of ammonia in one of their processes. Alert to the commercial possibility of making artificial fertiliser, they asked Haber to look into this. Their offer was so generous that the reluctant Haber agreed; graduate student Gabriel van Oort studied the thermal equilibrium of ammonia, nitrogen, and hydrogen at atmospheric pressure over an iron catalyst at 1200 °C. When van Oort's results gave a range for the equilibrium constant, Haber reported only the value at the higher, more commercially viable, end.

But the thermodynamics guru Walther Nernst disagreed, and disagreed publically. According to his calculations, Haber was wrong, and he challenged Haber to a public debate in 1907. Stung by the challenge, and a bit nervous, Haber asked Le Rossignol to repeat the work. Le Rossignol's experiments – conducted with several catalysts and at different temperatures – failed to obtain the favourable figure. In the public debate Nernst systematically destroyed Haber's results, but he also, somewhat sarcastically, suggested that they make measurements at higher pressures.

Haber must have been furious. Le Rossignol and Haber now looked closely at Nernst's work and realised that his own experiments were riddled with flaws. Le Rossignol set about extending the experiments, but with much more careful attention to the details of the gas flow. But the pressures were so high that the gas needed to be brought directly from the cylinder without a regulator. With a simple shut-off valve, fine control was impossible. With another forgotten figure, the technician Franz Kirchenbauer, Le Rossignol designed a new valve which consisted of a fine tapering metal cone with an angle of 88° that screwed into a conical valve body. The result was a narrow annular space that allowed the gas to be released with exquisite control, “bubble by bubble or by opening the valve still wider, in a rapid stream”. It was the first real “needle” valve and the design rapidly became part of modern industrial flow control.

As the work continued, Le Rossignol showed that the hydrogen/nitrogen equilibrium was well-behaved. Working across a range of temperatures and pressures, Haber and Le Rossignol amassed the arguments to comprehensively refute Nernst's claims. When Haber got his hands on some uranium and osmium catalysts from the Auer company (see CK98, October 2015), and found them to be really effective, Le Rossignol added a liquefier to allow the ammonia generated in the reactor to be removed continuously from the system.

On 2 July 1909, the prototype reactor was started in the presence of visitors from BASF, generating half a kilo of ammonia overnight. It was a dramatic success. As the focus shifted from lab to scale-up, for Le Rossignol the work was over. He joined the Osram lighting company but was interned when the first world war broke out. He was released, perhaps through Haber's intervention. He moved back to the UK after the war and spent the rest of his career doing research with GEC, his salary supplemented by royalties from the ammonia patent of which he was co-inventor.

There is no evidence that Le Rossignol resent his obscurity. He and his German wife remained friends with Haber to the latter's death in 1935, steadily giving their wealth away to charity. Perhaps some academics I know could take Le Rossignol as a role model. After all, the stakes may not be as high as you think.

### References

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