From 1911 to 1917, several developments contributed to the further stabilization of Bakelite. First there were a number of patent litigations, which further formed the newly emerging relevant social group of Bakelite engineers—partly because more chemists were enrolled from the celluloid chemists' group, and partly because the trials helped to explicate the Bakelite technological frame. Then there was the further collaboration with other industries. Third was the influence of World War I, and finally there was the influence of two more relevant social groups on the construction of Bakelite, industrial designers and consumers. I will briefly discuss these five strands of development that contributed to Bakelite's stabilization.

Patent Litigation

Almost at the same time that Baekeland's patents were issued, other researchers filed patents for phenol-formaldehyde condensation products. Most of these were primarily drying processes with all the related drawbacks.[149] The first really competing patents were filed by the German firm Knoll and Company (1907, 1908a,b) and their chemist Hans Lebach (1908). The similarities between this resin and Bakelite were obvious. Lebach, for example, also distinguished three types of condensation product: "Resit A," "Resit B," and "reine Resit" ("pure Resit"); the trade name was to be "Resinit" (Lebach, 1909a). For patent purposes it was of course crucial whether the two artifacts were indeed identical. The cards were ambiguously dealt: Lebach's U.S. patent was filed on 21 December 1908, more than a year *after* Baekeland's key patents, but Lebach's first patent, in Germany, was reportedly filed in February 1907 (Lebach, 1909c: 1599), five months *before* Baekeland's U.S. patents. The inventor who considered himself first had to argue for the identity of the two artifacts, while the one thinking himself second could only win by stressing the difference.

Baekeland asked whether there was "a real difference" (*ein tatsächlicher Unterschied*) (Baekeland, 1909d). In an article Lebach responded by extensively discussing Baekeland's analysis of the chemical formula for Bakelite and then suggesting some modifications. Surprisingly Lebach (1909c: 1600) then agreed with Baekeland about Resinit and Bakelite being almost identical, but his reason for doing so became clear in the same sentence: "Bakelite and Resinit are not very different at all, apart from the fact that Resinit, as is clear from the date of our German patent application and albeit Baekeland's contrary idea, was somewhat earlier conceived than Bakelit." Finally he discussed his process that provided,

he argued, a more simple, inexpensive, and small-scale method for hardening in the final production phase than Baekeland's heat-and-pressure process. His was the acid-hardening method: a 20–30 percent solution of HCl applied to a Resinit A or Resinit B mass would start the hardening process, but slowly enough to allow the molding, shaping, or casting of objects. After hardening, the acid could easily be washed out by rinsing with an aqueous soda solution.

Baekeland (1909e) cast doubt on the identity of Resinit and Bakelit, suggesting that Lebach's Resinit was a mixture of different chemical bodies rather than one polymerization product such as Bakelite C. Further, he doubted the technical feasibility of the acid-hardening process. This had, according to Baekeland, implications for the question of which product had come first:

> Dr. L. claims that Resinit was conceived before Bakelite. I agree completely with him if he means with the name Resinit any insoluble, infusible condensation product of phenol and formaldehyde. Indeed, he then can go back many years and cite the work of Baeyer, Kleeberg, Luft and Story and others, as I have done in my first article.
>
> However, it is not merely the issue to produce a specific chemical body. The problem is much more complex, since the goal is to produce and manufacture a product in such a way that it can be used reliably for very specific technical purposes.[150]

Lebach replied in the same issue of the *Zeitschrift für angewandte Chemie* by sustaining his claim of the identity of pure Resinit and Bakelite C, but he stressed again that his acid-hardening process was different from the Bakelite process. Baekeland would not be able to protect anything other than his heat-and-pressure process, Lebach concluded (1909d).

He was not right. As would become clear in the next few years, the patent situation was unusually satisfactory for Baekeland, because the process did not depend on a single patent or a single set of claims. Instead, the patents were so related that it was almost impossible to carry out anything practical without infringing on at least three or four patents at the same time. Moreover, the priority patent claimed by Lebach was not granted. On 1 November 1909, Baekeland agreed with Knoll & Company (of which Lebach was an employee) and with Rütgerswerke AG to found a German firm as licensee for the production of Bakelite. Thus the Bakelit Gesellschaft mbH. was established on 25 May 1910, and Lebach soon joined its staff. After this commercial closure of the controversy, the scientific controversy was closed as well. Baekeland (1911b, 1912, 1913) publicly recognized the value of the acid-hardening

process for specific purposes. In doing so, the identity between Bakelite C and acid-hardened Resinit was constructed after all.

The two other patent struggles, against the competing phenol-formaldehyde resins Condensite and Redmanol, resulted in 1922 in similar arangements when former competitors joined forces with Baekeland.[151] The first thread of this complex story starts in 1909 with J. W. Aylsworth, chemical consultant for Thomas A. Edison. Aylsworth was trying to develop a material for the manufacture of gramophone discs, which were to replace wax cylinders. He read Baekeland's papers, started research himself, and was granted several patents (Aylsworth, 1909, 1911a–h, 1912, 1913, 1915). Together with Kirk Brown, a wealthy man of considerable business experience, he formed the Condensite Corporation of America on 23 September 1910, which started production in an old Edison battery plant in Glen Ridge, New Jersey. Some six months later Brown and Aylsworth received notice from the General Bakelite Company that Condensite was infringing on the Bakelite patents and that they were accordingly warned to stop production immediately. In July, Baekeland (1911a) published a detailed and rather critical analysis of Aylsworth's Belgian patent. Brown called on Baekeland and they agreed that the Condensite Corporation would continue production under license of the General Bakelite Company, and that this license would be exclusive. Practical implementation of this agreement failed and another suit was filed, this time adjudicated in favor of Condensite. The General Bakelite Company agreed to pay royalties for use of two more recent patents by Aylsworth (1913, 1915). It was also agreed—and this would turn out to be consequential for the second development—that the General Bakelite Company was to bring suit against any party that infringed the Bakelite or Aylsworth patents (Haynes, 1945b).

The second thread of the big American patent struggle over phenol-formaldehyde resins started with a young Canadian chemist, L. V. Redman. Redman developed phenol-formaldehyde varnishes, applied for patents, and started a business in 1914 with Adolph Karpen, a Chicago manufacturer of furniture. The Redmanol Chemical Products Company began production of transparent cast resin and later expanded into the laminating and molding fields. Formica was an early Redmanol account. Inevitably the question arose of whether Redmanol was infringing on the Bakelite patents. The opening fight was conducted in academic circles. Redman et al. (1914) published a long and studious article that first reviewed all academic and patent literature, then carved out a niche for further study, and finally presented the new synthetic plastic. So much