

## **Chemistry vs. the Blockade: *Ersatz* Materials and German Explosives Production in World War I**

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As the British blockade tightened during the First World War and rationing or confiscation alone could not meet rising demands of the War Ministry, the German chemical and explosives industries turned to a variety of substitute or *Ersatz* materials, often using innovative production processes, to ensure a growing supply of propellants and explosives. These innovations affected not simply the production of nitrates (which will be covered in another presentation in this workshop), but almost all the critical materials required for explosives production including sulfates, glycerin, and cellulose. Shortages of toluene for TNT proved insoluble, however, leading to a shift toward various types of “substitute explosives” as well as the substitution of chemical agents for high explosives in shells. But as the war entered its final year, increasing quantity was accompanied by steadily diminishing quality, which ultimately became a contributing factor in German defeat.