

r+Impuls - Recovery of noble metals by the use of functional textiles

The recycling and recovery of high-priced noble metals such as platinum, gold, palladium and silver or strategic metals like indium, gallium, niobium, tantalum and rare earth metals from scrap and wastewaters will be of steadily increasing importance within the next years (and decades). Therefore, one big issue is the detection of potentially usable secondary resources and the development of inexpensive processes to separate and recover the metals selectively (Urban Mining). Beside electronic scrap industrial process waters and wastewaters represent a considerable source for noble metals. Various strategies for their recovery such as ion exchange, precipitations, extractions and electrolytic procedures plus combinations already exist. However, due to their poor selectivity the recycling of low-concentrated industrial process and rinsing waters is often not worthwhile using these existing metal recovery methods.

Now, we have developed an innovative textile, which allows the adsorption, separation and, therefore, inexpensive recovery of noble metals even from low-concentrated industrial process and rinsing waters, which were not considered as usable secondary resources so far. The innovative textile consists of inexpensive components and can be easily finished on industrial scale by using typical machinery from textile finishing processes. Textile structures excel in their high flexibility, high flow through properties, low weight, mechanical robustness, and last but not least low price. By a simple surface functionalization with polyelectrolytes, we have developed a new and promising class of technical textiles for the recovery of valuable metals.



Figure 1: Different stages of precious metal recovery with polyelectrolyte-finished textiles.

Such textiles are able to adsorb various noble metals, e.g. platinum, gold and palladium, especially from low-concentrated process waters generated by the metalworking industry. Recently, in cooperation with several industrial partners the feasibility of the overall concept (including textile production, textile finishing, plant design, filtration and metal recovery) was demonstrated successfully in operational environment, namely the producer of printed circuit boards. We succeeded in loadings up to 25 g Palladium/kg textile representing much more than 1000 Euro, whereas the textile itself costs just a few Euro. The innovative textile and its use for the recovery of precious metals were applied for European patents. Recently, in several European countries the patent was granted.

Our innovative adsorbing textile enables companies in many sectors, namely the metalworking industry, to recover high-value metals even from their low-concentrated process and rinsing waters, where it was impossible or not worthwhile so far. In addition, the textile industry benefits from our innovation. Textile producers and finishing companies were enabled to produce a highly innovative special product with low technical and economic effort representing a totally new class of technical textiles. Last but not least, plant manufacturers

can benefit from our innovation by planning, constructing and operating new textile-based filtrations modules for stationary or mobile use at various industries.

Moreover, our innovation opens up widespread applications in the rising fields of strategic metal recovery and environmental protection. For instance, our textiles are useful for the decontamination of chromate-polluted ground waters or the adsorption of arsenic from geogenic deposits. This could be an important and worldwide contribution to ensure the affordable cleaning of arsenic polluted drinking water in, e.g. India, Bangladesh, or Chile. Our latest investigations focus their use in the recovery of rare earth metals from process waters arising from large-scale catalyst production for the petroleum refining industry. Last but not least even the use in the mining sector (primary resources) is envisaged. Appropriate collaborations on scientific as well as industrial level have already started.

The project was awarded the Efficiency Prize NRW 2017 and the Techtexil Innovation Award 2019.

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Project Information:

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