



### Your benefits when using mechano-chemical methods

- Prevention of energy – intensive thermal and pyro metallurgical processes
- Recovery of target fractions without high concentrated and / or corrosive extracting agents
- Application for different class of materials possible (e.g. minerals, glasses, bio based materials, WEEE, etc.)
- Use of already mechanically processed materials, e.g. from material recycling possible
- Treatment of specific production-wastes with low volume possible
- Wide range of application-specific extracting agents usable (mineral acids, bases, complexing agents, etc.)
- Integration of mechano-chemically generated concentrates into existing recycling processes
- No gelation during the extraction process with siliceous materials

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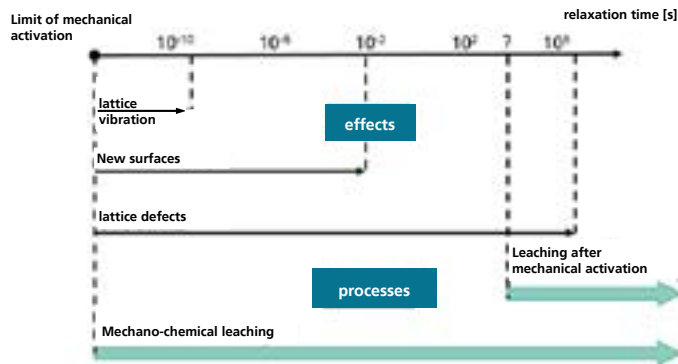
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## MECHANO-CHEMISTRY

THE SUSTAINABLE RECOVERY OF VALUABLE  
SUBSTANCES AND COMPONENTS





The processing of primary and secondary raw materials, with the objective of the selective extraction of certain resources or pollutants, in many cases involves processes which come with a high energy consumption (pyro metallurgical) and / or the use of highly concentrated extraction agents (acids, bases, etc.). Depending on the process further energy-intensive steps- such as preconditioning comminutions are necessary. These procedures cause high costs in an ongoing Process and also presuppose further investments in the safety-related field. This often makes – depending on the efforts required – a profitable treatment of a material flow impossible. So each day, thousands tons of inorganic composites currently end up in landfills, where they do not belong.

The solution to the problem is to provide an innovative method, in which the separation of the target-fraction, mostly from a mineral, glass- or plastic-like matrix, is ecologically and economically feasible. For this purpose the Fraunhofer Project Group IWKS provides an individually useable and adaptable method with its know-how in mechano-chemistry: This process is characterized by the use of low concentrated extraction agents or, with respect to the corrosion, of non-aggressive extracting agents and still can dissolve the desired material-fraction with comparatively low energy consumption. The solution can then be integrated in standard extraction processes of the chemical Industry resulting in a further reduction of the occurring costs.

### An innovative process – the mechano-chemical treatment of solids

The intensive mechanical stress and breaking processes during crushing lead to spatial and thus energetic disorder in the atomic or molecular structure, especially in the region of fine and ultra-fine particles. As a result these disturbances cause lattice defects, dislocations and phase transitions which ease the reaction of the particles with an extracting agent. The energy, necessary for the treatment, comes from the collisions of the grinding balls within a high kinetic grinding unit. At high rotation speed they lead to comminution and to partial amorphisation of the treated material. These effects can be used to extract well incorporated (metallic) components out of the surrounding matrix much simpler, more targeted and faster compared to conventional leaching. The process can be performed in two (mechanical activation in addition with extraction) as well as in one process step (mechano-chemical leaching). The latter has the advantage that temporary occurring disorders in the lattice can be used directly for the extraction process. This may lead to a higher extraction yield in a shorter process time. In addition, no disturbing gelation occurs as usual when it comes to the leaching of siliceous materials.

### Target groups and implementation in practice

Potential user can be found along the entire process chain of the recovery of valuable substances and components. In practice, next to the producers of wastes and production residues (recycling and processing industry) this concerns the chemical industry and the user of the obtained extracted material. In this context it is in general possible to deploy the mechano-chemically generated concentrates in standard hydrometallurgical processes, where they can be further treated to a reusable product. This allows a division of labor of different subject areas and hence minimizes investment – and running costs for the individual. This makes the targeted treatment of comparatively small material streams possible and affordable.

