

## **Elution of Lead from PZT to Acid Rain**

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The usage of lead in electronic devices is going to be prohibited because lead is a toxic element. Although a huge number of studies have been carried out so far to develop novel piezoelectric ceramics replacing PZT, most of them were failed. We must realize that lead is blessing of nature and cannot be replaced by other elements. Any elements are toxic in greater or less degree for human bodies. In this sense, the toxicity level should depend on their quantities. As a scientist, we should not accept a regulation prohibiting usage of any elements themselves, which is a kind of discrimination, but we should determine the regulation based on a scientific evidence. The regulation should involve the amount of the elements in our circumstances. The elution of lead in PZT to acid rain has been worried about for a long time but nobody has tried to measure the amount of lead eluted from PZT to acid rain. In this study, we tried to measure it.

It does not make sense to use PZT powder for testing because nobody uses PZT powder in electronic devices. The crashing of PZT ceramics to powder before disposal cannot be assumed because crashing of dense ceramics is a most expensive and energy consuming process. Therefore, measurement of lead elution should be carried out using PZT ceramics. The amount of the sample was normalized by the geometrical surface area rather than the weight of PZT ceramics. As the pH of recent severe acid rains is over 5, we employed a solution of pH.4 for testing. Several PZT plates with the size 10 x 10 x 0.5 mm were suspended in a 1,000 ml solution at 40 degree C. The concentration of lead in the solution was measured with ICP as a function of time. The amount of lead eluted from PZT was much less than that expected and it depend on ceramic processing. The amount of elution form industrial PZT was smaller than that of labo-made PZT. The 10 mol% replacement of lead with barium was effective to reduce the lead eluted from ceramics. The amount of lead eluted from PZT was dominated by the lead remaining at grain boundaries in ceramics.

From the results of testing, we simply concluded that PZT is not dangerous at all.