

Rapid determination of the corrosion properties of lead alloys

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Application of lead on roofs.



Binary lead alloys on a test rack at TNO in Den Helder.

Lead has been used for at least 5,500 years. Nowadays, properties like a high corrosion resistance and its malleability, durability and flexibility still make lead unique for a number of applications such as the extensive use of lead sheets in the building industry. To improve specific application properties, lead is alloyed with various elements. The lead alloys used for buildings have an attractive appearance, low production costs and a low runoff rate.

From environmental and health perspective, however, further reduction of runoff from buildings is desirable.

To investigate the long-term corrosion properties, lead sheets of experimental alloys have to be exposed outdoors for a number of years. Rainwater from the exposed samples has to be collected and analysed for the contents of lead and its main alloying elements. From these results, the runoff rate can be calculated.

In the current work, the outdoor performance of lead alloys is compared to the results of electrochemical measurements performed in the laboratory. For the latter, electrochemical cells were mounted on duplicates of the alloys. Concentrated (artificial) rainwater served as electrolyte. The corrosion potential and polarisation resistance was monitored until a stable value was reached.

Up to now, five alloys have been measured, and the results of the electrochemical measurements can be related to the runoff rate. As expected, the alloys with a low corrosion resistance show a high runoff rate when exposed outdoor. The alloys that develop a high corrosion resistance by building up a protective layer, show a low runoff rate. It is clear that the addition of alloying elements influences the formation of a protective layer. Subsequently, the quality of this layer can be related to the runoff rate.

It can be concluded that results of electrochemical measurements appear to be helpful for the rapid determination of the corrosion and runoff properties of lead alloys. Outdoor exposure of lead alloys requires years to determine the long-term corrosion properties, while electrochemical measurements allow a ranking of these properties within four weeks.

Keywords : lead, polarisation resistance, accelerated corrosion test, outdoor exposure.