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Data Article

Atmospheric corrosion of metals in industrial city environment

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ABSTRACT

Atmospheric corrosion is a significant problem given destruction of various materials, especially metals. The corrosion investigation in the industrial city environment was carried out during one year exposure. Corrosion potential was determined using the potentiometric method. The highest effect of corrosion processes was observed during the winter season due to increased air pollution. Corrosion of samples pre-treated in tannic acid before the exposure was more difficult compared with the samples without pretreatment. The corrosion products determined with the SEM/EDS method prove that the most corrosive pollutants present in the industrial city air are SO_2, CO_2, chlorides and dust.

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Specifications table

Subject area	*Chemistry*
More specific subject area	*Corrosion of metals*
Type of data	*Tables, figures*
How data was acquired	*Potentiometric measurements were performed using μAutolab potentiostat/galvanostat, SEM/EDS analysis*
Data format	*Analysed*
Experimental factors	*Metal samples were mechanically grounded with abrasive paper, rinsed with distilled water, degreased with aceton and dried in air*
Experimental features	*Potentiometric curves were recorded in a three-electrode cell, morphology of sample surface was investigated by the SEM/EDS method*
Data source location	*Lodz, Poland*
Data accessibility	*The data is with this article*

Value of the data

- Changes in corrosion potential were related to atmospheric conditions.
- Surface of metal samples was characterised after the exposition to industrial city environment by SEM/EDS analysis.
- Tannic acid was applied as corrosion inhibitor before exposition to the environment.

1. Data, experimental design, materials and methods

1.1. Sample preparation

Corrosion investigations were carried out with the application of metal samples: iron, industrial copper and zinc samples. Surface area of metal samples exposed to performance of atmospheric corrosion factors was 2 cm^2. Prior to the measurements, each sample was mechanically grounded with 600 grade of abrasive paper, rinsed with distilled water, degreased in acetone (CH_3COCH_3) of analytical grade and dried in air.

1.2. Electrochemical studies and surface analysis

Electrochemical measurements were carried out using a three-electrode cell with Pt counter electrode and saturated calomel electrode (SCE) as a reference electrode. Surface area of metal samples exposed to atmospheric corrosion was 2 cm^2. An electrical contact to the metal sample was made of the same metal as a sample and was inserted in a Teflon tube in order to insulate it from the solution. Potentiometric curves were recorded in μAutolab electroanalytical instrument (Metrohm-EcoChemie, The Netherlands). In order to estimate a change in the susceptibility of tested metals and alloys to atmospheric corrosion, their corrosion potential (E_{corr}) was measured in specially prepared solution in open circuit for 30 min. The solution was prepared using distilled water with additions of the following chemicals: NaCl (30 mg dm^{-3}), Na_2SO_4 (30 mg dm^{-3}) and $NaHCO_3$ (30 mg dm^{-3}) and was naturally aerated in order to simulate the industrial city environment. Changes in the susceptibility to corrosion can be caused not only by varying meteorological conditions and pollution of air but also by coverage of tested metal and alloys with various corrosion products.