Characterization and recycling possibilities of hazardous materials from waste management of electrical and electronic medical equipment

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Abstract

Electrical and electronic waste (WEEE) is one of the fastest growing and most complex flow components of global waste and one of the most troublesome. Metals and other materials play a key role in the operation of electrical and electronic equipment (EEE) as their properties provide unique functionality to consumer products. Metals can theoretically be infinitely recycled. Television and computer monitors using cathode ray tubes (CRTs) were widespread for many decades. They have recently been replaced by Plasma, LCD, LED and OLED screens. Their gradual replacement leads to a large amount of waste which is sent for recycling in accordance with the provisions of Directive 2012/19/EU of the European Parliament and of the Council of July 4, 2012 regarding waste electrical and electronic equipment. The lead content is not constant in all parts of the CRT. Varies by department. The parts with the highest lead content, and therefore immediately usable, are the funnel, which is the largest part of the CRT by mass, with a lead content of 22-28% wt. The screen, or panel, contains much smaller amounts of lead, usually around 3-5%. From the above it can be seen that this quantity approaches the contents required for the manufacture of radio-protection glasses, which makes crushed CRT a suitable raw material for the manufacture of such glasses. However, the funnel does not only contain pure glass. It is coated with a conductive coating that usually consists of particles of graphite and iron oxides in a solution of sodium silicate (Na2SiO3). Lead glass is a variety of glass from which the CRT is made. In this, lead oxide replaces calcium oxide, typically at 18-40% (sometimes more). Lead glass is used in decoration but also in high-tech applications (cathode ray lamp, radiation protection glasses). Radiation protection glasses are lead glasses used to protect humans from harmful radiation such as X-rays and γ-rays. The usual manufacturing dimensions of these glasses range from 1.5m x 2.5m. Thicknesses range from 6 - 12 mm depending on the expected performance. In order to examine methods aimed at recycling and reusing the glass of funnels and screens, thereby reducing the environmental footprint of the electrical and electronic waste that is piled up in recycling companies, a study is being carried out into the possibility of using this glass for the construction of cages and installations, permeable to light, in order to provide radiation protection. Glass blocks are manufactured from the specific material and their characteristics in terms of the linear attenuation coefficient of the radiation in real conditions are examined by experimental measurements.

Keywords: Glass of funnels and screens, radiation protection glasses, recycling, reusing, waste electrical and electronic equipment