Prediction of wear rates in comminution equipment

Raw material comminution equipment may be exposed to excessive wear, which makes it difficult to operate minerals processing plants continuously because lengthy and unplanned shut-downs interrupt the overall process. In general, most comminution equipment is fine-tuned to operate at low vibrations and to achieve guaranteed performance. From an economical point of view, it is always preferred to replace all worn parts during the planned maintenance shutdowns. When operating comminution equipment, the wear rate receives little attention and is considered a secondary matter. However, experience shows that a wear map can give eye-opening information on the wear behavior. A wear map provides insight into the interaction between the abrasive and the wear part material being studied. In this paper, three wear maps with highly different properties are compared. Testing was performed on an abrasion-resistant high chromium white cast iron (21988/JN/HBW555XCr21), a heat-treated wear resistant steel (Hardox 400) and a plain carbon construction steel (S235). Quartz, which accounts for the largest wear loss in the cement industry, was chosen as abrasive. Other process parameters such as velocity (1–7 m/s) and pressure (70–1400 kPa) were chosen to closely imitate real industrial processes. The authors are aware that a number of wear mechanisms such as erosion, fatigue and abrasion may occur simultaneously in comminution equipment. Nonetheless, this paper aims at discussing abrasion only due to its large contribution in the material removal process. The vertical roller mill has received special attention and this paper also discusses a simplified view on wear.