

## 11.5 Applications of Continuous Melt Crystallization

With the specific advantages of melt crystallization mentioned in Section 2, as well as the merits of continuous processes (including stable product quality, higher productivity, higher automation, *etc.*), intensive investigations have been devoted to the applications of continuous melt crystallization. In this section, processes for separation of organic mixtures, production of ultra-pure products and concentration are summarized, separately.

### 11.5.1 Separation of Organic Mixtures

Isomers and organic compounds with similar structures and properties could be separated by using the continuous melt crystallization method advantageously. For example, Kim *et al.*<sup>8</sup> applied the direct contact cooling method to separate *n*-dodecanol and *n*-decanol. Results showed that the obtained crystals were of good quality and significantly larger than those from scraped crystallizers. The separation effect was higher than that of film crystallization in terms of purity and production. 99.97% (mass purity) *p*-dichlorobenzene could be obtained from 87% feed, with an annual production capacity of 7000 metric tons using a Kureha purifier.<sup>33</sup> By using a cooling disk crystallizer, Diepen *et al.*<sup>32</sup> investigated the influence of different operation conditions on the permeability of caprolactam products, obtained from caprolactam-water mixtures. Misztal<sup>48</sup> designed a continuous MSMRP crystallizer which could remove the fines from melt crystallization of caprolactam and developed an algorithm to calculate the crystal size and its distribution.

### 11.5.2 Production of Ultra-pure Inorganic Products

Phosphoric acid, one of the most essential chemical materials, is widely used in the manufacture of pharmaceuticals, foodstuffs, semiconductor elements and in other fields. Because of the high efficiency and low operation cost, crystallization has been one of the preferential options for the purification of phosphoric acid. Chen *et al.*<sup>7</sup> applied a continuous melt suspension crystallization process which includes a MSMRP crystallizer and a gravity washing column to purify phosphoric acid and found the operation window to produce food grade products. In addition, solid layer crystallization has been successfully used for the purification of inorganic materials, such as silicon and germanium. Boutin *et al.*<sup>41</sup> applied a continuous fractional crystallization on a rotary drum and a zone melting process to purify metals. By adjusting the relative position and distance between the drum and the bottom of the trough, the apparatus could be used to produce pure aluminum and protect it from oxidation during the melt crystallization.