An integrated replenishment model with quantity discounts, reentry and downward substitution for control wafers

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Abstract

This paper considers control wafers replenishment problem in wafer fabrication factories. A dynamic lot-sizing replenishment problem with reentry and downward substitution is examined in a pulling control production environment. The objective is to set the inventory level so as to minimize the total cost of control wafers, where the costs include order cost, purchase cost, setup cost, production cost and holding cost, while maintaining the same level of production throughput. In addition, purchase quantity discounts and precise inventory level are considered in the replenishment model. The control wafers replenishment problem is first constructed as a network, and is then transformed into a mixed integer programming model. Lastly, an efficient heuristic algorithm is proposed for solving large-scale problems. A numerical example is given to illustrate the practicality for empirical investigation. The results demonstrate that the proposed mixed integer programming model and the heuristic algorithm are effective tools for determining the inventory level of control wafers for multi-grades in multi-periods.

Keyword：Control wafers; Dynamic lot-sizing; Quantity discounts; Replenishment; Mixed integer programming.