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Preliminaries on AMHS: Lessons learned[*¥]

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Abstract

As the semiconductor industry is in the planning stages for its next wafer diameter increase (i.e. from 300mm wafers to 450mm wafers), the design of highly efficient wafer fabrication factories (fabs) and automated material handling systems (AMHS) is critical to enable high productivity and reduce costs. Learning from previous experiences, this research analyzes –from a managerial perspective – critical factors driving the decisions concerning how to plan the transition to the next generation AMHS. These factors were identified from a comprehensive literature review focused on the issues and challenges of the wafer diameter transitions, particularly from 200mm-300mm wafers. The main factors studied include wafer transition cost, cost reduction, research and development, information management, standardization, material and equipment. The lessons learned of this analysis are summarized and reported.

Key words: Manufacturing, Facilities planning and design, Feasibility study, Semiconductor wafers, Automated Material Handling Systems

1 Introduction

An effective automated material handling system (AMHS) design improves production and manufacturing performance of the wafer fabrication facility (fab). The effectiveness of the system as well as the investment's rate of return are primary concerns related to the decision on the acquisition of production equipment of wafer fabrication. The performance of the semiconductor industries has been based on the belief of Moore's law. Moore's law predicts that the numbers of transistors on a chip will double every 18 to 24 months by reducing the chip's cost per function (i.e. transistor cost) by 30% [1]. A more competitive business environment in manufacturing and especially in the semiconductor industry calls for a rethinking of performance according to Moore's law.

Wafer manufacturing evolved from 200 mm to 300 mm wafer size and then to 300 Prime. 300 Prime is strategy geared towards improving current 300 mm manufacturing efficiency and bridging into compatible manufacturing architecture of 450 mm. Some key issues rest on when and how semiconductor manufacturing should move/transition to 450mm wafers. The 300Prime stage requires more research and development to prepare fabs for 450mm transition and manufacture 300mm equipment that can bridge to 450mm equipment, thereby giving manufacturers enough time to recuperate manufacturing costs from the last transition.

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