

A FUZZY AHP-BASED FAULT DIAGNOSIS FOR SEMICONDUCTOR LITHOGRAPHY PROCESS

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ABSTRACT. *Because the lithography process accounts for almost half of semiconductor manufacturing cycle time, a reliable and easy-to-implement fault diagnosis for this process is critical to productivity and profitability. Accordingly, this study proposes the approach of fuzzy analytic hierarchy process (FAHP) for the ambiguous fault evaluations of lithography process. The application of FAHP has several advantages over conventional approaches because it's able to quantify the managerial causes of lithography faults and to homogenize the differences among the subjective judgments of on-site engineers. Together with the fuzzy set theory, this study provides a systematic mechanism to construct a hierarchy of FAHP model and a FAHP diagnosis map for the lithography process. The model hierarchy of goal, criteria and indicators can be updated and reviewed periodically in order to cope with the dynamic business environment. Meanwhile, the diagnosis map can summarize the FAHP rating list of fault causes, which is useful for manufacturers to prioritize their improvement plans in order to allocate their limited resources efficiently. Our empirical example also demonstrates the feasibility of the proposed FAHP approach without detailed error reports. Hence, semiconductor manufacturers can refer this study for their decision support of fault diagnosis on the complicated lithography process.*

Keywords: Lithography, Fault diagnosis, Analytic hierarchy process, Fuzzy set theory

1. **Introduction.** Lithography is the process by which photoresist is exposed and developed to form relief images of integrated circuits onto semiconductor substrate during wafer fabrication. Micro-scale specifications of integrated circuits can be produced through this photographic transfer. As new generations of integrated circuit devices require a decrease in line widths and minimum feature sizes, the development of lithography technology directly influences the advances of semiconductor manufacturing. Among the technologies of lithography, optical methods of wafer imaging have been dominant in the semiconductor