Forecasting Optical Lithography - A Fool's Errand !

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Optical lithography, and specifically ArF immersion lithography, has been extended to resolution well below the Rayleigh limit, and is currently being used to print features at $1/20^{th}$ of the optical wavelength in high volume manufacturing (HVM) for the critical layers of semiconductor devices. This has been done by innovative processes and the continuous improvement in existing 300mm scanners with better accuracy and throughput to enhance total output value per input cost. Much of this achievement has been accomplished by extensive computational techniques that have been integrated with various hardware components and sub-systems. These techniques have a 40-year history and were created from a wide range of disciplines including physics, chemistry, optics, electrical engineering, computer science, mathematics, materials science and mechanical engineering.

Nobody predicted this. Indeed, over the years, the semiconductor lithography industry has seen many forecasted technologies fail to achieve dominance in HVM, even though they all claimed technical superiority. This trend continues today with technologies such as EUV lithography, which was forecasted to be in HVM for the 45nm node. While EUV has made enormous progress, its entrance into HVM remains plagued by many more technical issues that make the value equation questionable.

This talk will examine some of the history of technology prediction with an attempt to forecast the future possibilities and scenarios in optical lithography. We will discuss the potential innovations and ideas that may carry us into the future, with a specific concentration on manufacturing possibilities.