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Determination of phase change correction on gauge block measurement in two different interferometric measurement system

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Phase change correction is an important correction value of the end effect in an optical interferometry system. Normally, this value is used to compensate for gauge block measurement by an optical interferometry system based on ISO 3650:1998. Quartz plates and three different types of gauge block: steel, ceramic, and tungsten carbide were used in this study. Two different interferometric measurement systems in terms of fringe fraction (a phase shift method and an average slits method) were determined for the phase change correction by a five-stacking method. These results are used to determine the length measurement of gauge blocks in an optical interferometer technique and consequently, to evaluate the uncertainty of gauge blocks measurement. The preliminary results are shown that the value of phase change correction in a phase shift gauge block interferometer (PSGBI) system and a standard uncertainty are 35.3 nm and 6.2 nm, respectively. In contrast, the values from an average slits gauge block interferometer (ASGBI) system and a standard uncertainty are 66.0 nm and 6.4 nm, respectively. We found that the phase correction from the PSGBI system is lower than ASGBI about 20.6 nm because the PSGBI's wave-front correction is more complete than the systematic error of ASGBI leading to the low value of phase correction in the end effect. However, the lengths of gauge blocks of all three materials measured by the two different systems were consistent as assessed by En number. According to the study, we can conclude that phase change correction is based on the characteristics of each GBI system, material types of gauge block and optical plates such as the fringe fraction technique, and wavefront error compensation. Consequently, measurements that require a high accuracy should determine the phase change correction before each measurement due to this value is not interchangeable.

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