Developing an automated mass comparator for sub-milligram weights to achieve the weight calibration with the world's best calibration capability

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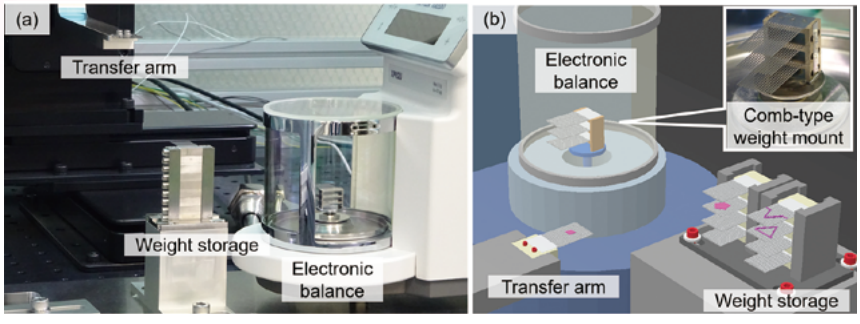
In cutting-edge research fields, such as analyzing pollutant particles in air, it is necessary to measure small masses of sub-milligrams with high accuracy. In these studies, it is essential to ensure the reliability of mass measuring instruments by using mass-calibrated weights. Traditionally, at NMIJ, the calibration of the weights involved a comparative process with reference weights using an electronic balance. Conventionally, small weights of less than 1 mg are calibrated by manually transferring the weights to an electronic balance using tools such as tweezers. This procedure, however, causes instability in measuring small weights. Therefore, NMIJ has developed an apparatus for the mass calibration of various shapes of small weights by automatically transporting the weights with a uniquely designed comb-shaped weight mount. This apparatus was used to reduce the variation in the weighing values of the weights to less than half. Thus, it is now possible to calibrate the masses of weights from 100 μg to less than 1 mg with the world's best calibration capability. In March 2021, NMIJ started a mass calibration service for the weights using this apparatus.

Reference: Y. Ota et al., *Measurement* **198**, 111320, 2022, DOI: 10.1016/j.measurement.2022.111320



(a) Developed mass comparator for sub-milligram weights with automatic transfer system
(b) Automatic transfer of a small weight by the developed apparatus