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size effect and plastic strain gradient on the springback behavior of metallic materials in microbending process

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Highlights:

- The interaction of the grain-based size effect and the strain gradient effect on springback is investigated.
- A combined constitutive model simultaneously considering both the grain size effect and strain gradient was proposed.
- Pure microbending experiments using copper alloy sheet metal samples with the thickness of 0.1, 0.2, and 0.4 mm were conducted.
- The springback angles calculated using the established model were corroborated by the experimental results, providing model validation.
- The quantitative expression of contribution of each effect on springback can be obtained based on the proposed mixed constitutive model.

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