# Supporting Information

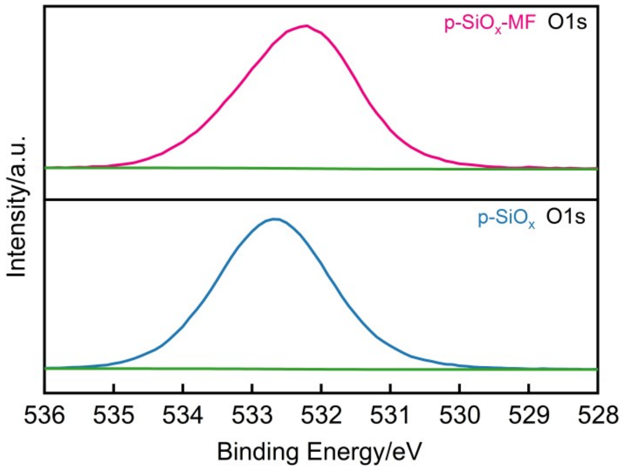


Figure S1. XPS spectra of O1s.

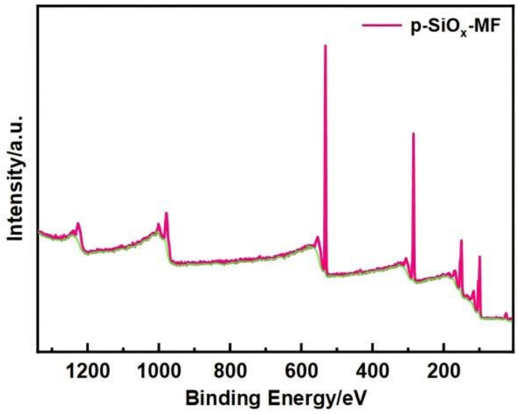


Figure S2. XPS survey spectrum of the as-prepared p-SiOx-MF composite.

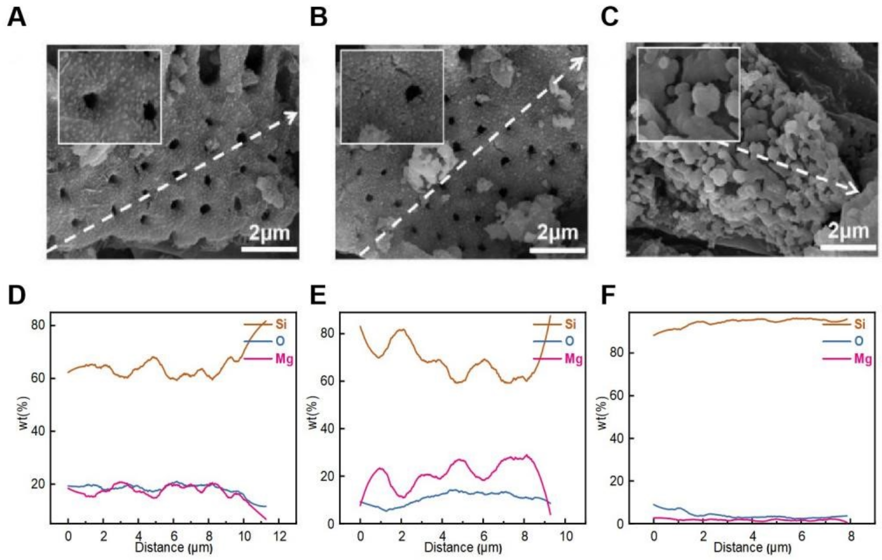


Figure S3. SEM image of (a) SiOx-MF and (b) p-SiOx-MF and (c) SiOx-MF. linear sweep of (d) SiOx-MF and (e) p-SiOx-MF and (f) SiOx-MF.

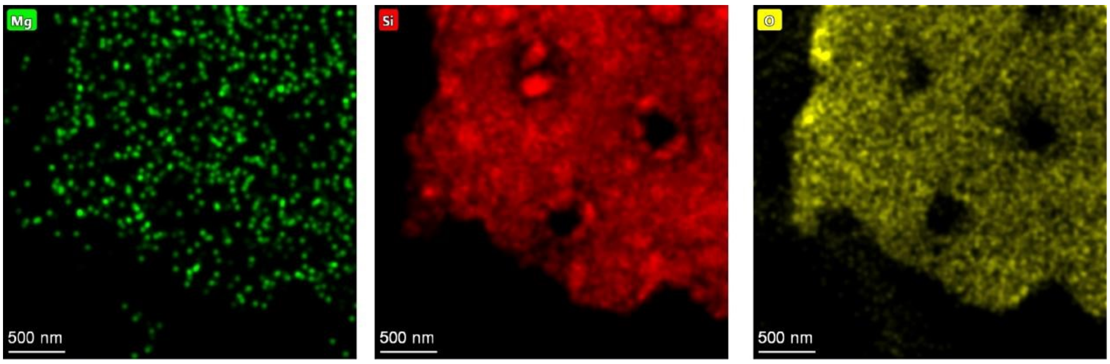


Figure S4. Corresponding EDS mapping of p-SiOx-MF.

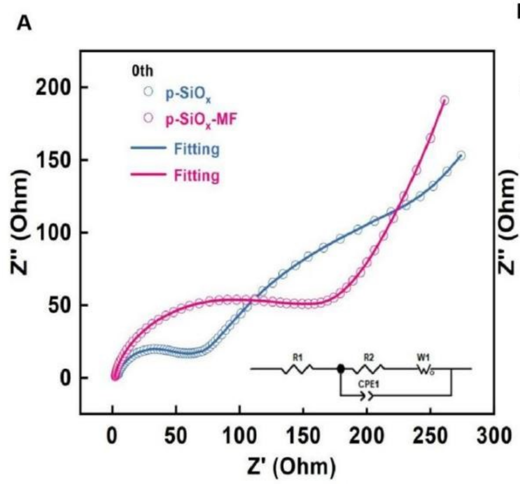


Figure S5. Nyquist plots of p-SiOx-MF and p-SiOx insert shows the equivalent circuit model of the studied system.

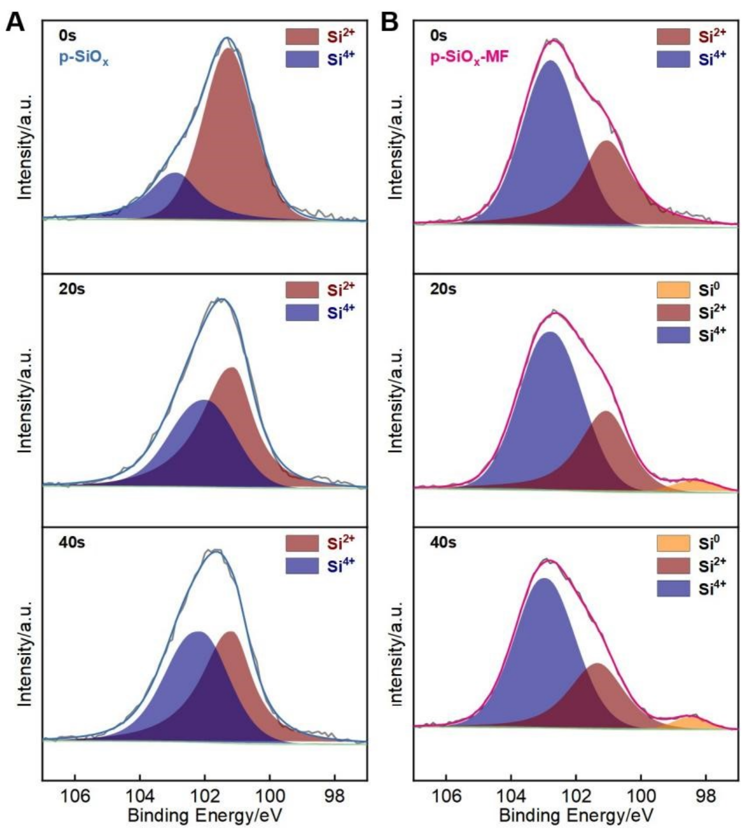


Figure S6. XPS profiles of Si 2p of (A) p-SiOx and (B)p-SiOx-MF after the 5th cycles. All spectra were measured in the middle of the film after etching and then charge-corrected.

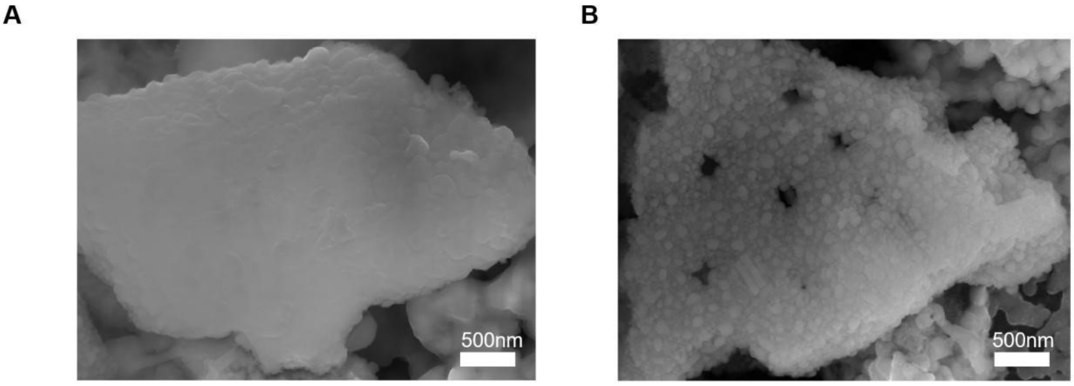


Figure S7. SEM image of (A)p-SiOx-MF and (B) SiOx after the 5th cycles.

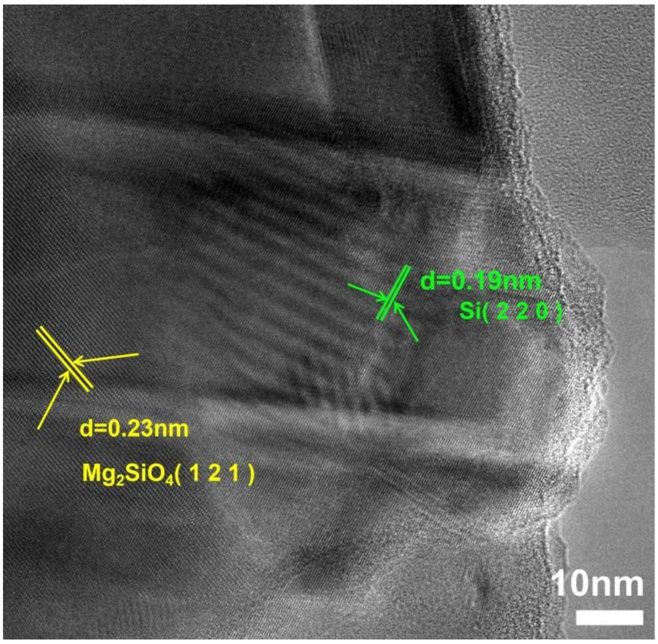


Figure S8. TEM image of p-SiOx-MF after the 5th cycles.

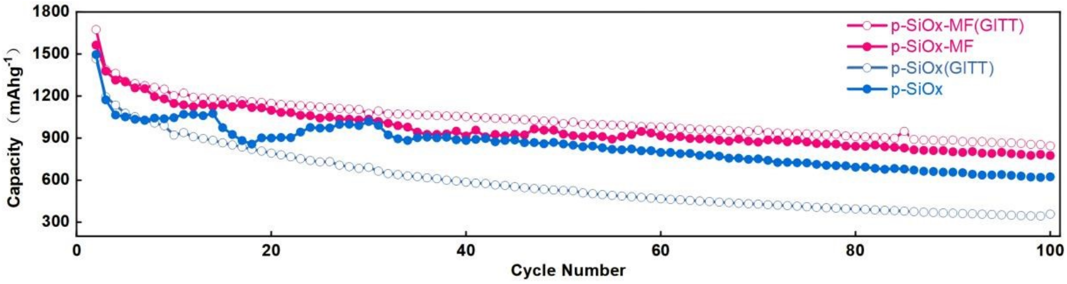


Figure S9. Impact of periodic GITT testing on long-cycle stability (3rd, 10th, 30th, 50th, and 100th tests constitute GITT evaluations).

TableS1. Comparison of different working performance

| Material System | Initial Coulombic Efficiency (%) | Reversible Capacity (mAh/g) | Cycling Performance |
|---|---|---|---|
| **p-SiOx-MF（This work）** | **56** | **2494** | **775.8atmAhg$^{-1}$ after 100 cycles** |
| Ji et al. (2024) d-SiO/C/LSO | 90.3 | 1465 | 45.2% capacity retention after 100 cycles at 0.5C in half-cell; 86.5% retention after 100 cycles in NCM811 full-cell |
| Li et al. (2023) High-density Si-C composite | 83.5–85.0 | ~600 | 96.2% retention over 200 cycles at 0.5C; 70.6% retention over 200 cycles in LFP full-cell |
| Liu et al. (2025) Si@h-$SiO_x$/C | ~69.0 | 1520 | 70% retention over 300 cycles at 1 A/g; 94.4% retention for 300 cycles in pouch cell |
| Mamiya et al. (2023) SiO-C stacked film | — | 2188.8 | 94% capacity retention over 500 cycles at 0.1C |
| Sun et al. (2023) $SiO_x$/C with different carbon microstructures | 69–85 | 700–900 | 92.2%–98.5% retention after 100 cycles |
| Youn et al. (2024) Porous Si/Ca-Si-O | 86.4 | 964.3 | 55% capacity retention over 200 cycles |
| Single carbon-coated SiO | 76.7 | 1737 | 33.3% retention after 100 cycles at 0.5C |
| Single LiH-prelithiated SiO | 81.0 | 1438 | Only 1.2% retention after 100 cycles at 0.5C |
| Commercial graphite | 92–94 | 372 | ≥90% retention after 100 cycles at |

| Material System | Initial Coulombic Efficiency (%) | Reversible Capacity (mAh/g) | Cycling Performance |
|---|---|---|---|
| | | | 1C |

References：


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