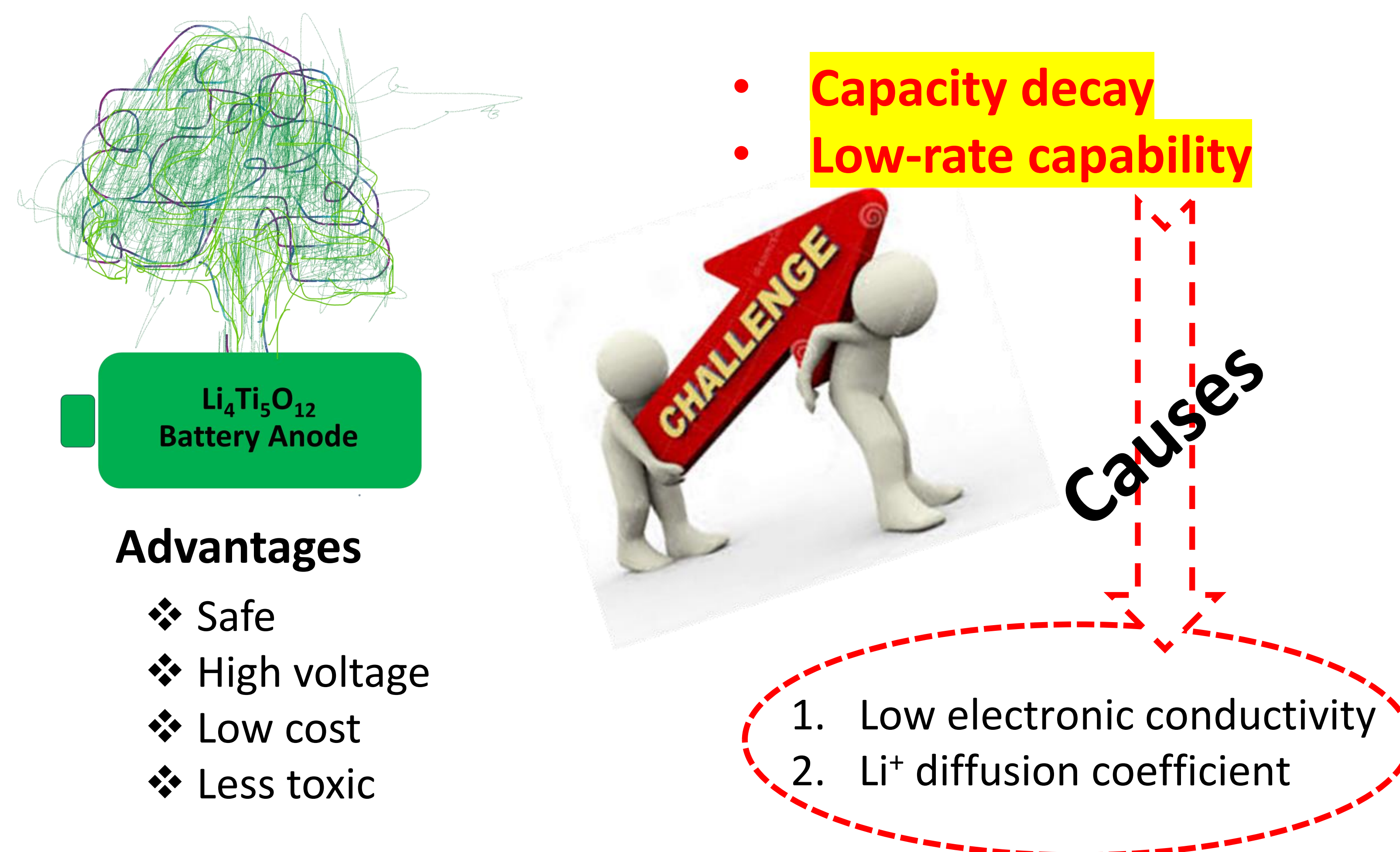


Microwave irradiation enhanced electronic conductivity and Li^+ diffusion coefficient in Spinel $\text{Li}_4\text{Ti}_5\text{O}_{12}$ anode material for lithium-ion batteries

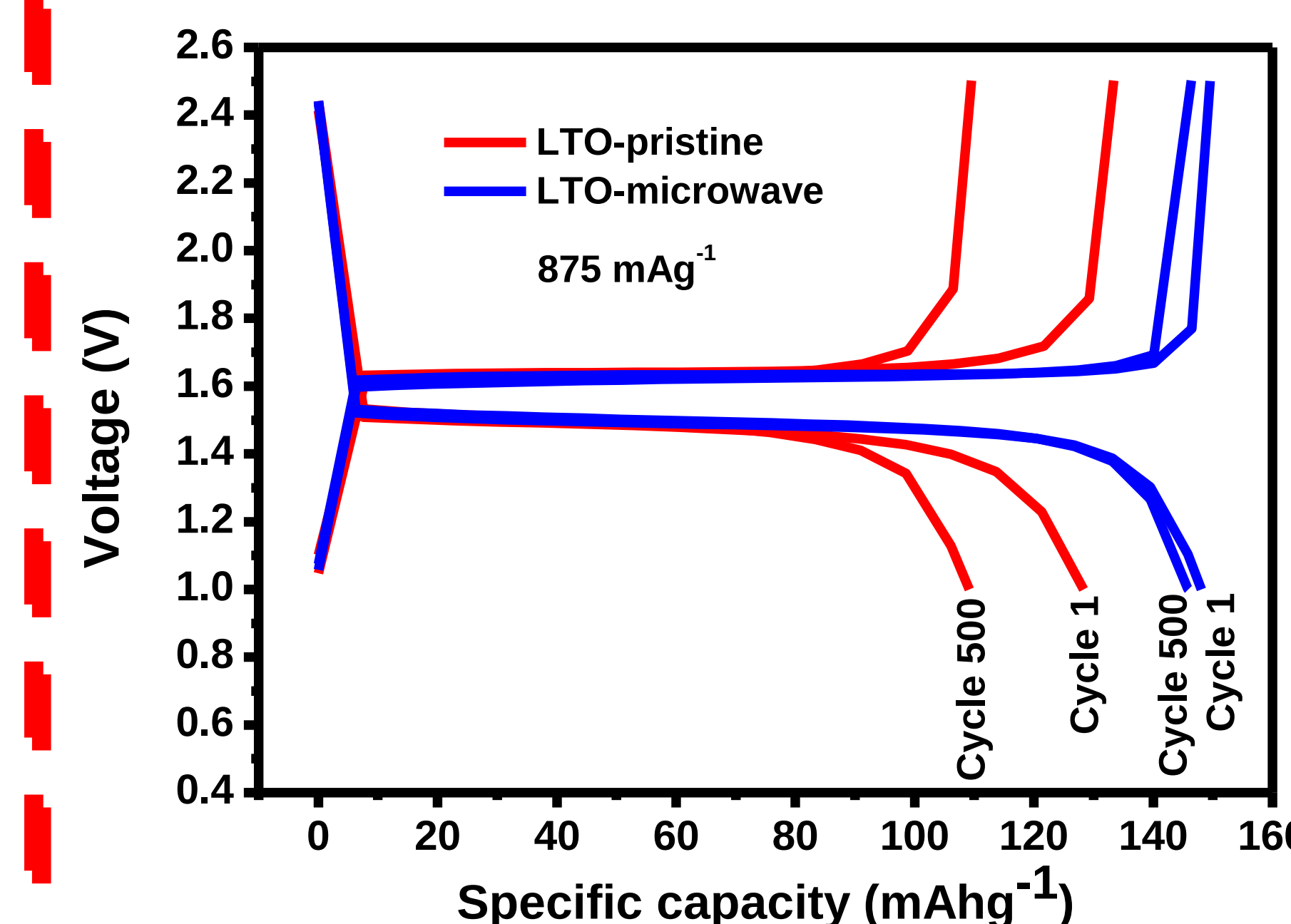
Aderemi B. Haruna and Kenneth I. Ozoemena
 School of Chemistry, Molecular Sciences Institute, University of the
 Witwatersrand, Johannesburg, South Africa
 Email: aderemi.haruna.wits.ac.za

Introduction

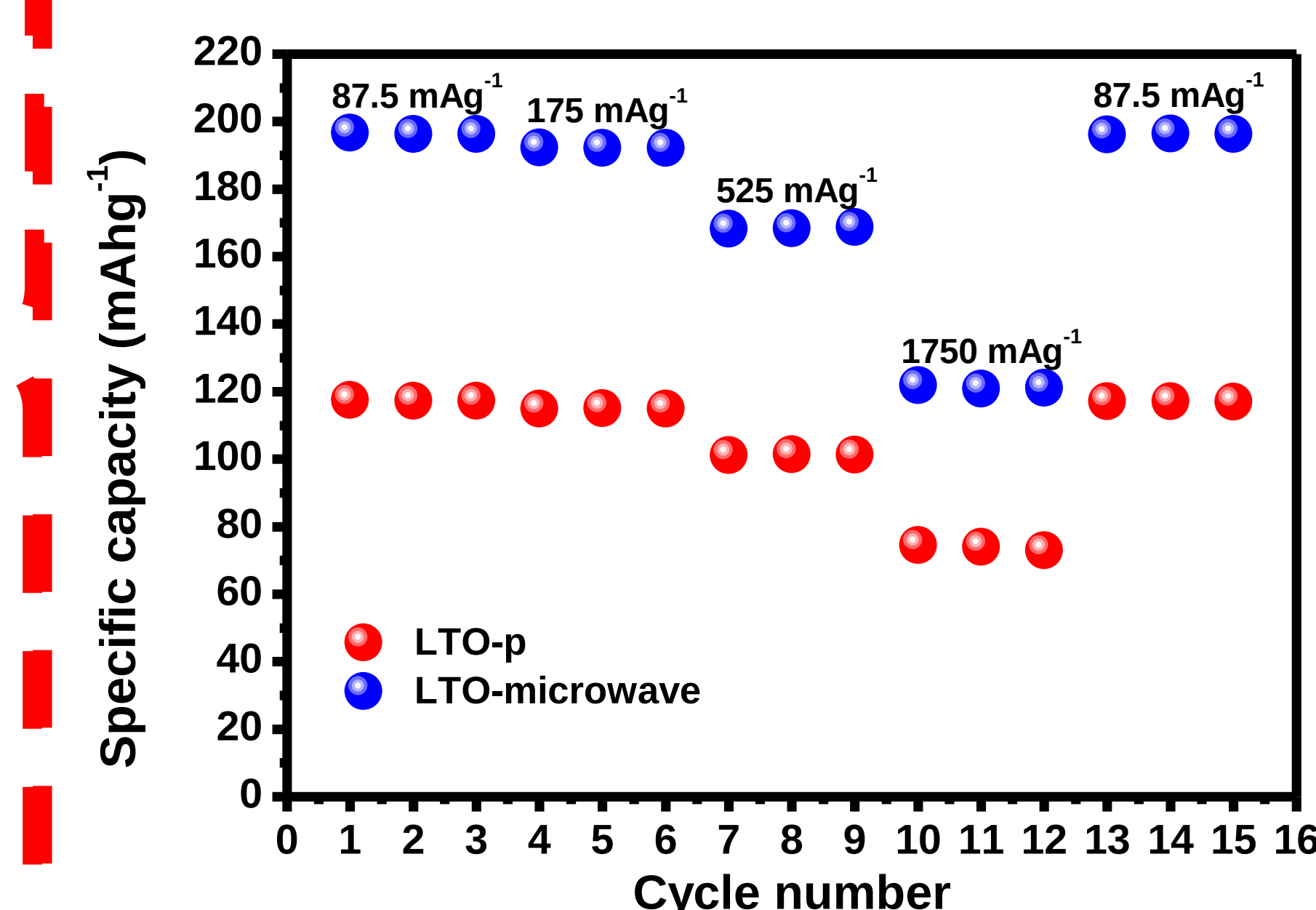
Low electronic conductivity and Li^+ diffusion coefficient are the key challenges to the practical application of $\text{Li}_4\text{Ti}_5\text{O}_{12}$ (LTO) as anode material for lithium-ion batteries. This novel work explored efficient and environmentally friendly synthesis method that is significantly energy saving without the use of toxic reagents and organic solvents (**sustainable chemistry principles**). The innovative technology and energy efficient microwave irradiation enhanced the limiting low electronic conductivity and Li^+ diffusion coefficient in the commercialized LTO (LTO-p) materials. Thus, significantly increased the battery's energy and cycle life. This is a simple, low-cost and environmentally benign scale-up modification process for the development of high-performance lithium-ion batteries



Results



- ❖ Microwave irradiation increased the specific capacity by **15.4%**
- ❖ Microwave irradiation reduced the capacity decay (capacity loss per cycle after 500 cycles at 875 mA g^{-1} : **LMO-microwave = 0.0029%** while **LMO-p = 0.03%**)



- ❖ Microwave irradiation increased the rate capability

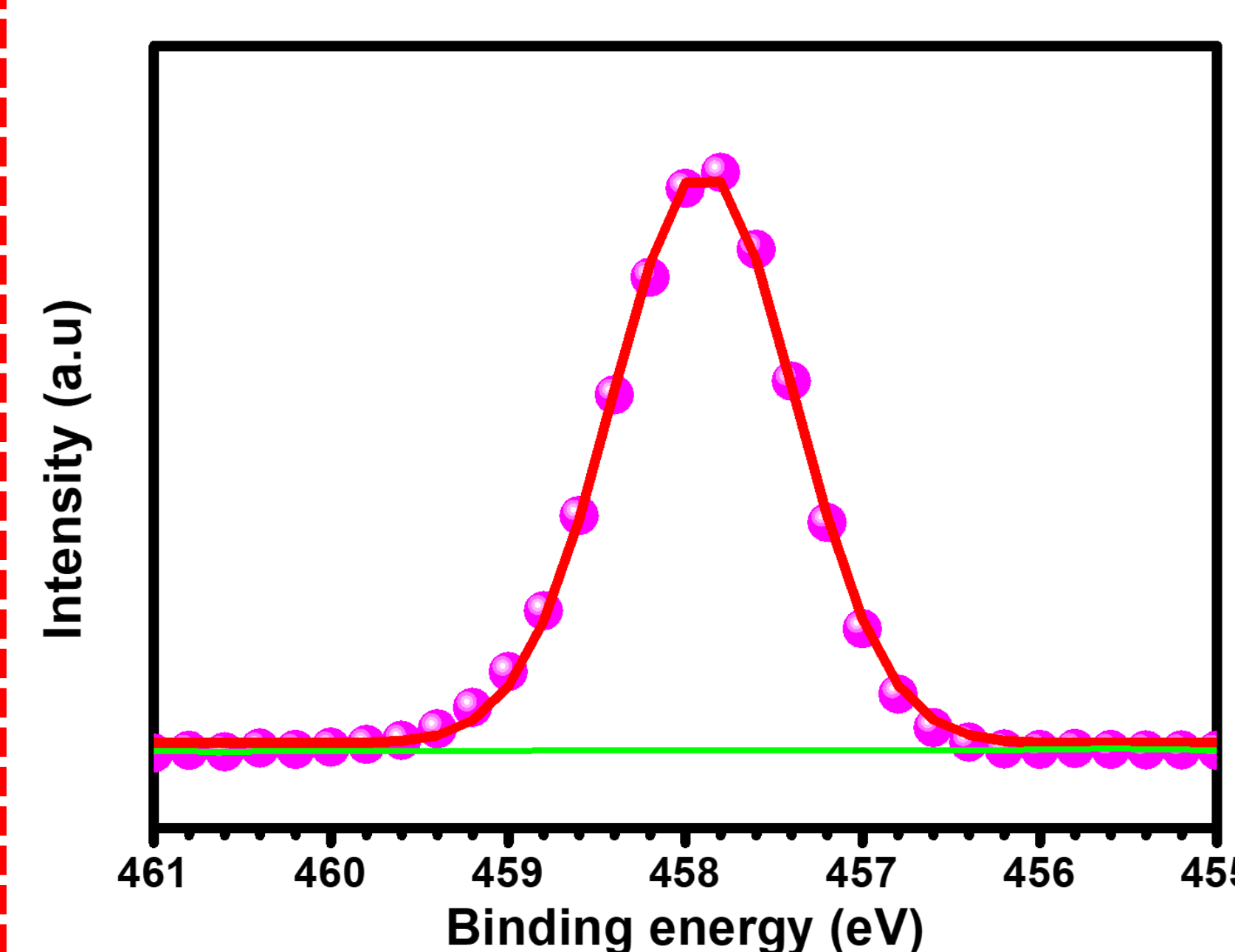
Conventional Strategy

1. Cation doping
2. Surface coating

Disadvantages

1. Dopants increase the cost of materials
2. Non uniform coated surface
3. Complex synthesis

This research strategy

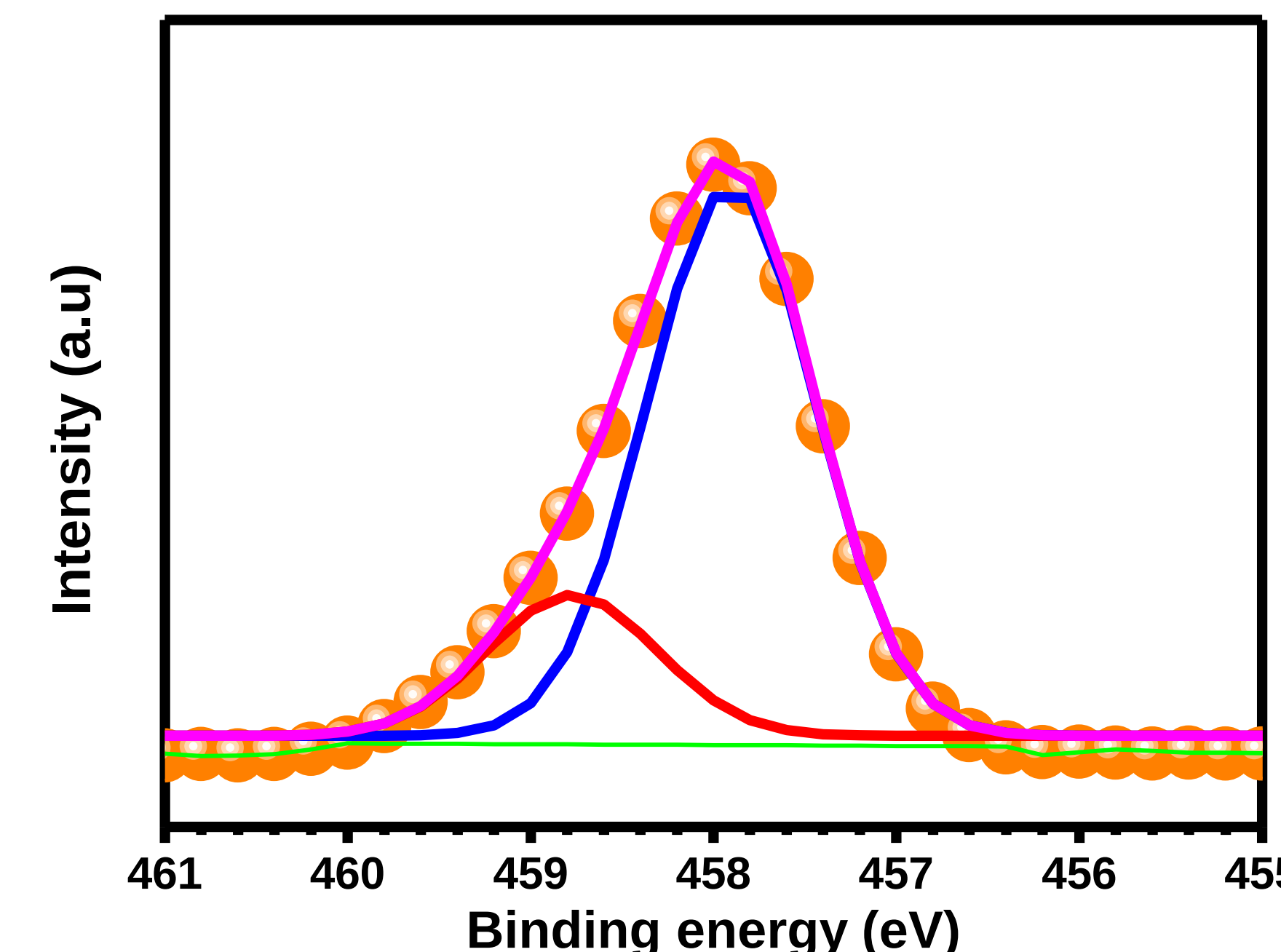


LTO: Ti^{4+} Non-conductive

Green chemistry process
 Microwave irradiation

Advantages

- ❖ Energy saving
- ❖ Time saving
- ❖ No doping
- ❖ No surface coating
- ❖ Reduced cost
- ❖ Environmentally friendlier



LTO: $\text{Ti}^{3+}/\text{Ti}^{4+}$ Conductive

Conclusion:

The microwave irradiation has been used as a strategy to

- introduce conductive Ti^{3+}
- increase the specific capacity & Reduce the capacity decay
- Increase rate capability without the use of toxic reagents and organic solvents

