

International Advanced Research Centre for Powder Metallurgy & New Materials (ARCI)

Balapur P.O., Hyderabad – 500005, Telangana, India



Design, Integration and Demonstration of Super capacitor Powered and Hybrid Electric Vehicles

Overview

The concept of electric vehicle powered by Super capacitor alone as well as hybrid has been designed, integrated and demonstrated during on road conditions. To integrate the super capacitor bicycle, 18 commercial SC (Maxwell) cells with individual cell specifications of 3400 F, 2.85 V and 3.85 Wh (stored energy) were procured, connected in series to obtain a module with 51.4 V and 69 Wh sufficient to run the electric motor in the bicycle. Further, the capacitor management system (CMS) has been developed to regulate the voltage and current in each cell during charge/discharge cycles. In order to extend the driving range of E-bike to 2.5 km, boost converter has been designed to boost up the voltage by recovering the remaining stored energy in SC module. Parallely, hybrid module has been developed containing 3 Lead acid batteries (12V 14Ah: 3 pack) connected in series with 3 super capacitors (2.7V, 650F, 0.66 Wh). The super capacitors aids in cranking as well during acceleration. The developed bicycles have been successfully tested during on-road conditions.

Key Features

Super capacitor powered EV:

- * No. of cells in module: 18 cells connected in series
- * Total stored energy: 69 Wh
- * Usable energy: 27.0 Wh
- * Nominal voltage, V: 51.3 V
- * Charging time: 4 minutes
- * Driving range: 2.5 Km with booster circuit

Hybrid EV:

- * Lead acid battery (36 V 14 Ah) has limitations in terms of life and power delivery
- * Initial high power delivery (400 W) reduces the life time of lead acid battery
- * SC (2.85 V; 650 F) provides high power (400 W) delivery for initial cranking during start and acceleration thus increasing lifespan
- * On-road charging (2 Wh per charge) and peak power delivery while running
- * Hybrid EV has a maximum speed of 25 kmph with motor capacity of 250 W



Super capacitor powered Electric Bicycle



Hybrid (super capacitor assisted and lead acid battery powered) E-bicycle.

Potential applications:

- Automotive transport (electric bicycles, mini-bus, etc.)

Technology Readiness Level (TRL): 6

- Super capacitor bicycle has been integrated and demonstrated.
- Booster circuit has been designed to extend the range of super capacitor E-bicycle.
- Super capacitor module has been adopted in addition to lead acid battery pack for initial cranking and acceleration.

Intellectual Property Development Indices (IPDI)

IPDI*	1	2	3	4	5	6	7	8	9	10
Activities	Basic concepts and understanding of underlying scientific principles	Short listing possible applications	Research to prove technical feasibility for targeted application	Coupon level testing in stimulated conditions	Check repeatability/consistency at coupon level	Prototype testing in real-life conditions	Check repeatability/consistency at prototype level	Reassessing feasibility (IP, competition technology, commercial)	Initiate technology transfer	Support in stabilizing production
Status										

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