



TUBALL® BATT

Nanomodifier of materials

Cathode



The Tuball Batt® suspension is for use as an additive into the electrode mass during the preparation of cathodes for Li-ion batteries with different cathode chemistry. The application of Tuball Batt® results in a substantial increase in the cycle life of Li-ion batteries, as well as in an increase in the discharge and charge power of batteries.

The main component of Tuball Batt® is the unique material Tuball® produced by OCSiAl – the only company in the world capable of large scale production of single and double walled carbon nanotubes (SWCNT/DWCNT) at a price enabling the use of this material in mass production. The use of high quality SWCNT in the preparation of Tuball Batt® allows increasing the cycle life of Li-ion batteries even when adding quantities as low as 0.01% (as a percentage of dry residue) into the electrode material.

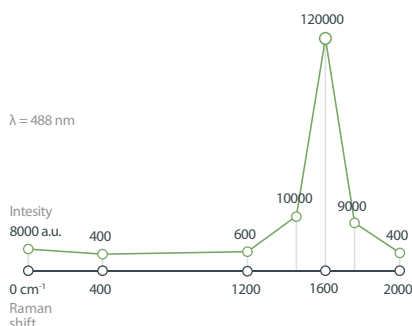
Tuball Batt® is supplied in standard containers of 1, 5, 20 and 200 liters and is used in standard technological processes through the addition into (or as a complete substitution of) the standard technological solvent at the stage of preparation of electrode slurry.

TECHNICAL DATASHEET

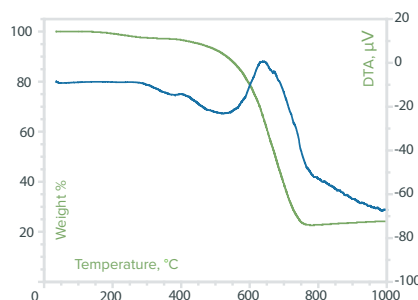


Specifications	Unit of measure	Value	Method of evaluation
Carbon content	wt.%	~83	TGA, EDX
CNT	wt.%	~75	TGA
Number of layers CNT	unit	1-2	TEM
Outer mean diameter CNT	Nm	1-3	Raman, TEM
G/D ratio	unit	~100	Raman
Metal impurities	wt.%	~17	EDX, TGA

RAMAN SPECTRUM



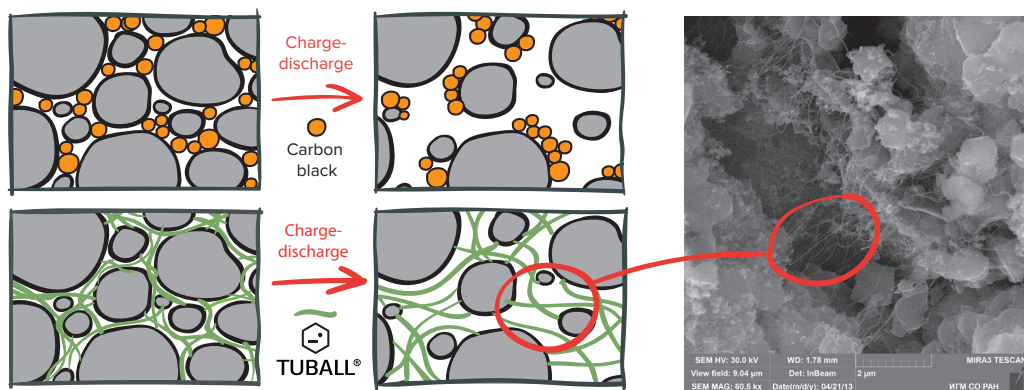
TGA CURVES



WHY TUBALL®

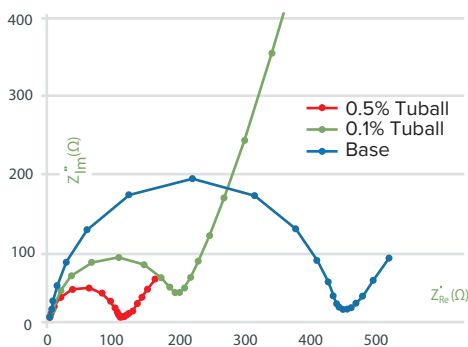
When properly dispersed in the electrode mass, Tuball® provides internal reinforcement inside the electrode and improves its mechanical stability during the charge/discharge cycles, thereby preventing the appearance of cracks and the creation of “dead zones” in the electrode during prolonged use. Tuball® is an excellent conductive additive ensuring quality electrical contact throughout the whole body of the active cathode material.

In contrast with multi walled carbon nanotubes, carbon nano-fiber and other similar materials, the use of the Tuball Batt® material does not lead to significant changes in the viscosity of the electrode slurry and, as a consequence, does not require any significant changes to the already established technological processes. This is possible due to the unique properties of the material, and also due to the proprietary industrial technology for the highly efficient dispersion of single and double walled nanotubes in a suspension, without significant negative effects on the surface and length of nanotubes, specially developed by OCSiAl for this purpose.



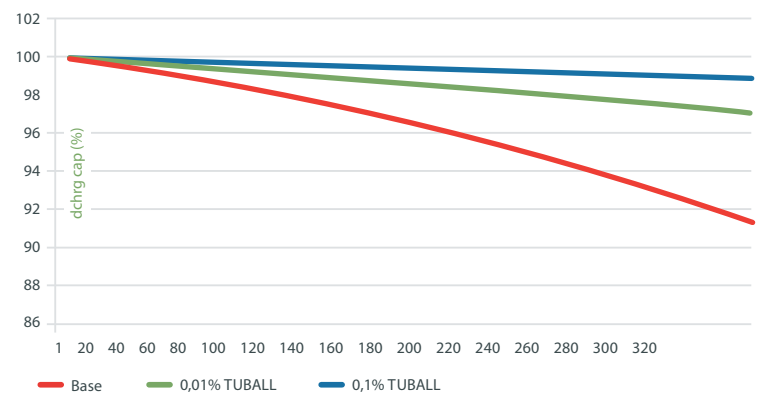
RESULTS TUBALL®

IMPEDANCE SPECTRA OF CELLS



EFFECT ON CYCLABILITY

Cycling 0.5C – chrg 1C dchrg;
23°C; 100% DOD 100mAh pouch cell
C-LFP (2.5-3.65V)



Testing conducted by OCSiAl in 2013. The data is approximated. The data provided for descriptive purposes only and is not intended to make or imply any guarantee or warranty. Results may depend on cell type, the cathode chemistry and characteristics of the process.