ECOMATERIAL TECHNOLOGIES

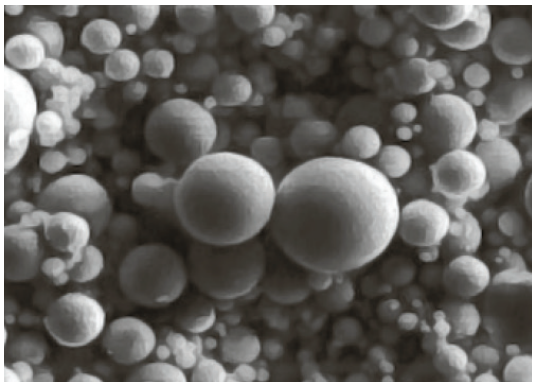
TECHNICAL BULLETIN

Celceram

for Thermoplastics

WHAT IS CELCERAM®?

Celceram® or "Cellular Ceramic Materials" are comprised of solid and semi-solid calcium aluminosilicate glass spheres. Celceram® products are multi-functional reinforcing fillers for various polymer systems. The source for these complex inorganic glass structures is the minerals which have melted and then fused into glass spheres during combustion of 100% coal in power generating processes. The Celceram® products are considered to be pre-consumer recycled content as defined by the UL® Environment's Green Guard.



Scanning Electron Micrograph of Celceram® Glass Spheres

APPLICATIONS

Celceram® has been successfully used as a functional filler in Polyolefins, Engineered Resins, Elastomers, Rubber (natural, synthetic and silicone), PVC and Thermoset Resin systems. The engineered particle size distributions and particle sizes contribute to improved dispersion and homogeneity. Celceram® can typically be incorporated at high loading levels while maintaining or improving the physical characteristics of the finished polymer systems.

Polypropylene Pellet

FLAME RETARDANT PROPERTIES

Fly ash fillers can be used as a synergist to enhance flame retardant (FR) properties and/or help reduce the level of FR chemicals that are required to meet the UL94 V0 FR rating. Through various studies it has been reported that fly ash can be used as an FR synergist in several polymers, such as Polypropylene (PP), Polyethylene (PE), Polycarbonate (PC), Polyvinyl Chloride (PVC), Nylon and Epoxy resin systems.[1]

Revision Date: 1-2-23

ECOMATERIAL TECHNOLOGIES

THERMAL PROPERTIES

Studies show-

- Incorporation of fly ash in HDPE enhances both the thermal stability and the effective thermal conductivity of the composites[2]
- The thermal degradation tests showed that the presence of ash improved the thermal stability of PP[3]
- The heat distortion temperature increased with increasing concentrations of fly ash filler for both the 60µ and 8µ particle sizes in filled Nylon 6 composites[4]

ELECTRICAL PROPERTIES

Studies show-

- It was observed that on addition of fly ash the dielectric strength increased drastically with both the 60µ and 8µ particle sizes in filled Nylon 6 composites[4]
- Incorporation of fly ash in Polypropylene increases the dielectric constant of the PP composite[5]

ECONOMICS

Celceram® can often be used at higher filler loadings than traditional fillers while maintaining or improving most physical characteristics. A higher filler loading decreases the concentration of the costly polymer system, resulting in a possible savings over traditional filler materials.

ABOUT ECO MATERIAL TECHNOLOGIES

Eco Material Technologies offers a full line of Engineered Materials for specialized applications. Eco Material Technologies' research facilities are staffed with

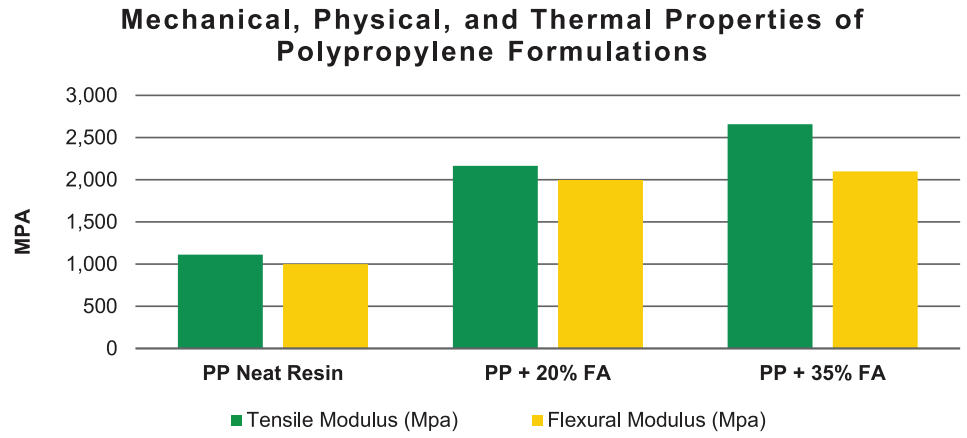
professionals that can assist in developing products that are suited to your specific needs. These materials are highly modified to impart performance driven characteristics in the final product. Whether you are looking for strength, reactive pozzolanic systems, or functional fillers that target improved rheological characteristics in aqueous and polymer systems, Eco Material Technologies has the Engineered Materials to make success a reality.

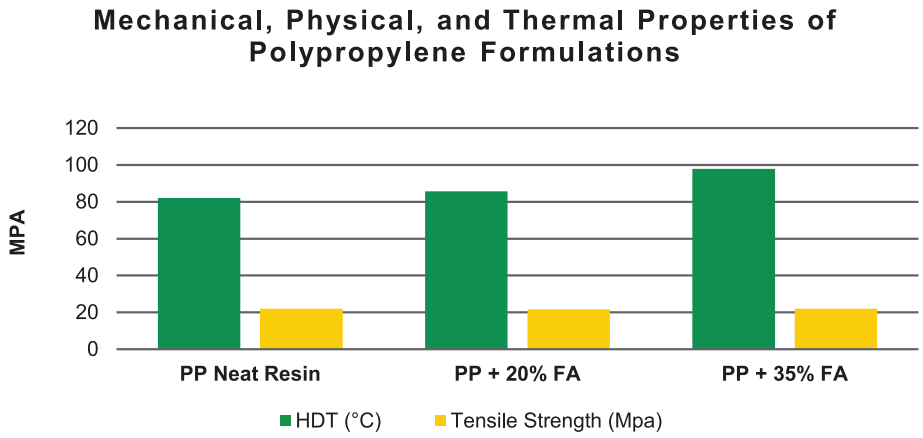
Because Eco Material Technologies cannot control the final use of its products, there are no warranties expressed or implied regarding a product's use or performance in any given circumstance. Persons receiving this information should make their own tests to determine suitability for their particular use.

1. Fly Ash Based Fillers and Flame Retardants. By: Yang Dong, Junder Jaw, Shih-yaw Lai, Performance Materials Center, Beijing, China
2. Effective Thermal Conductivity and Coefficient of Linear Thermal Expansion of High Density Polyethylene – Fly Ash Composites. By: Sanjib Baglari, Madhusree Kale, T.K. Dey
3. Rheological, Thermal and Mechanical Characterization of Fly Ash – Thermoplastic Composites with Different Coupling Agents. By: S.G. Pardo, C. Bernai, A. Ares, M.J. Abad, J. Cano, Grupo de Polimeros, Departmentos de Fisica, E.U.P. -Ferrol, Universidad de A Coruna, Ferrol, Spain and Grupo de Materials Advanzoles INTECIN (UBA-CONICET), Universidad de Buenos Aires, Argentina
4. Effect of Flyash On The Mechanical, Thermal, Dielectric, Rheological And Morphological Properties Of Filled Nylon 6. By: Suryasarathi Bose and P.A. Mahanwar, Plastics & Rubber Division, University Institute of Chemical Technology, Mumbai, India
5. Effect of Flyash Addition on Dielectric Properties of PP. By: Navin Chand, Nidhi Khare, Regional Research Laboratory, Bhopal, India

MECHANICAL, PHYSICAL, AND THERMAL PROPERTIES OF POLYPROPYLENE FORMULATIONS

	Tensile Strength (Mpa)	Tensile Modulus (Mpa)	Flexural Modulus (Mpa)	HDT (°C)
PP Neat Resin	22	1113.21	1000	82
PP + 20% FA	21.77	2166.7	1996.84	85.72
PP + 35% FA	22	2658.71	2099.18	97.92

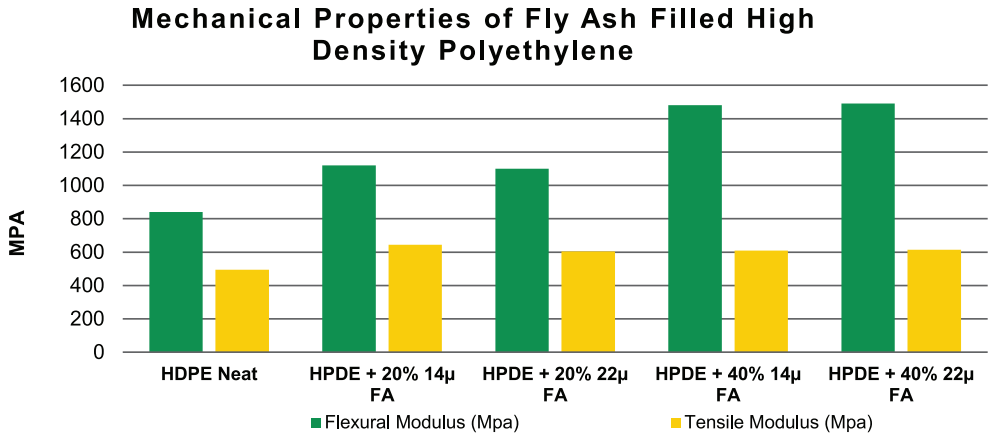


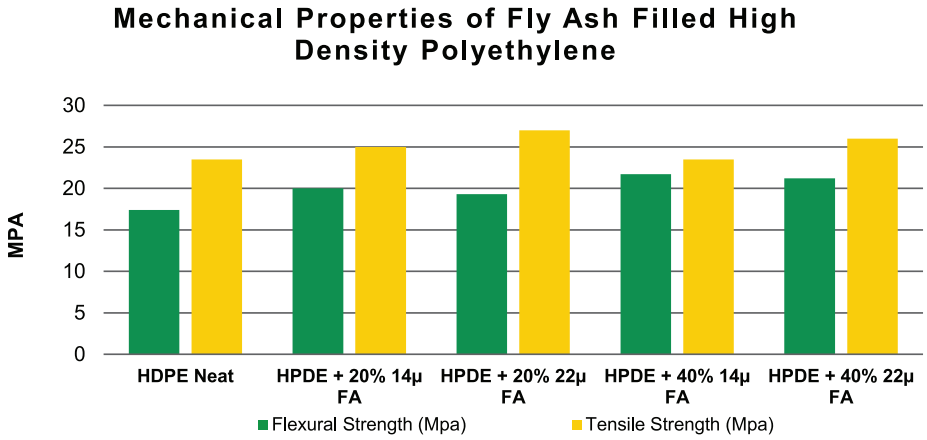


Reference: Utilisation of Fly Ash As a Filler In Plastics. Industrial Research and Development Institute Toronto, Canada.

MECHANICAL PROPERTIES OF FLY ASH FILLED HIGH DENSITY POLYETHYLENE

	Flexural Strength (Mpa)	Flexural Modulus (Mpa)	Tensile Strength (Mpa)	Tensile Modulus (Mpa)
HDPE Neat	17.4	840	23.5	495
HPDE + 20% 14µ FA	20	1120	25	645
HPDE + 20% 22µ FA	19.3	1100	27	605
HPDE + 40% 14µ FA	21.7	1480	23.5	610
HPDE + 40% 20µ FA	21.2	1490	26	615



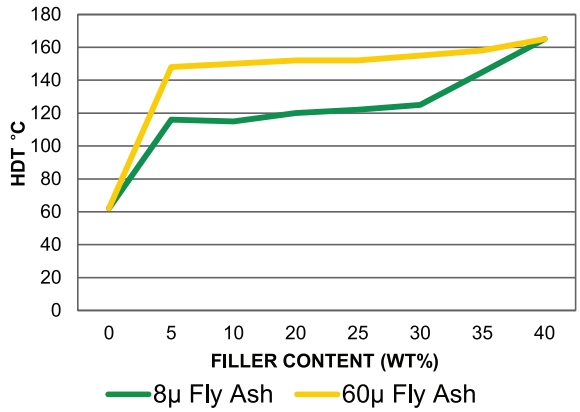


Reference: Mechanical Properties of Fly Ash Filled High Density Polyethylene. By: Iftekhar Ahmad and Prakash A. Mahanwar – Department of Polymer Engineering and Technology, Institute of Chemical Technology, Mumbai University, Mumbai, India.

HEAT DISTORTION TEMPERATURE OF NYLON 6 COMPOSITE

Filler Content (wt%)	0	5	10	20	25	30	35	40
8µ Fly Ash	62	116	115	120	122	125	145	165
60µ Fly Ash	62	148	150	152	152	155	158	165

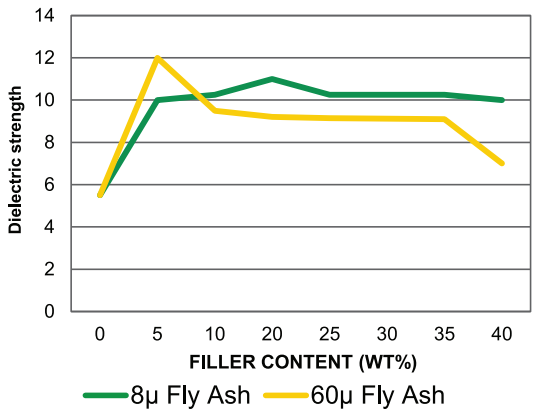
Variation in heat distortion temperature of different particle size fly ash with varying concentration



DIELECTRIC STRENGTH OF NYLON 6 COMPOSITE

Filler Content (wt%)	0	5	10	20	25	30	35	40
8µ Fly Ash	5.5	10	10.25	11	10.25	10.25	10.25	10
60µ Fly Ash	5.5	12	9.5	9.2	9.15	9.125	9.1	7

Variation in dielectric strength of different particle size fly ash with varying concentration



Reference: Effect of Flyash On The Mechanical, Thermal, Dielectric, Rheological And Morphological Properties Of Filled Nylon 6. By: Suryasarathi Bose and P.A. Mahanwar, Plastics & Rubber Division, University Institute of Chemical Technology, Mumbai, India.