ZESPÓŁ HAL TECHNOLOGICZNYCH

Nazwa aparatu: Plastometr obciążnikowy – CEAST MF20 (Instron)

Zakres warunków operacyjnych: aparat przeznaczony do pomiarów wskaźników szybkości płynięcia MFR (masowy wskaźnik szybkości płynięcia) i MVR (objętościowy wskaźnik szybkości płynięcia) w określonych warunkach temperatury i obciążenia.
Aparat wyposażony jest w obciążenia: 1,2 kg; 2,16 kg; 5,0 kg
Aparat pracuje zgodnie z normami: ISO 1133, ASTM D1238

Zastosowania: porównanie tworzyw o różnej zwartości napełniacza, określenie wpływu rodzaju napełniacza na właściwości reologiczne tworzywa, identyfikacja tworzyw, kontrola jakości surowca, charakterystyka materiału

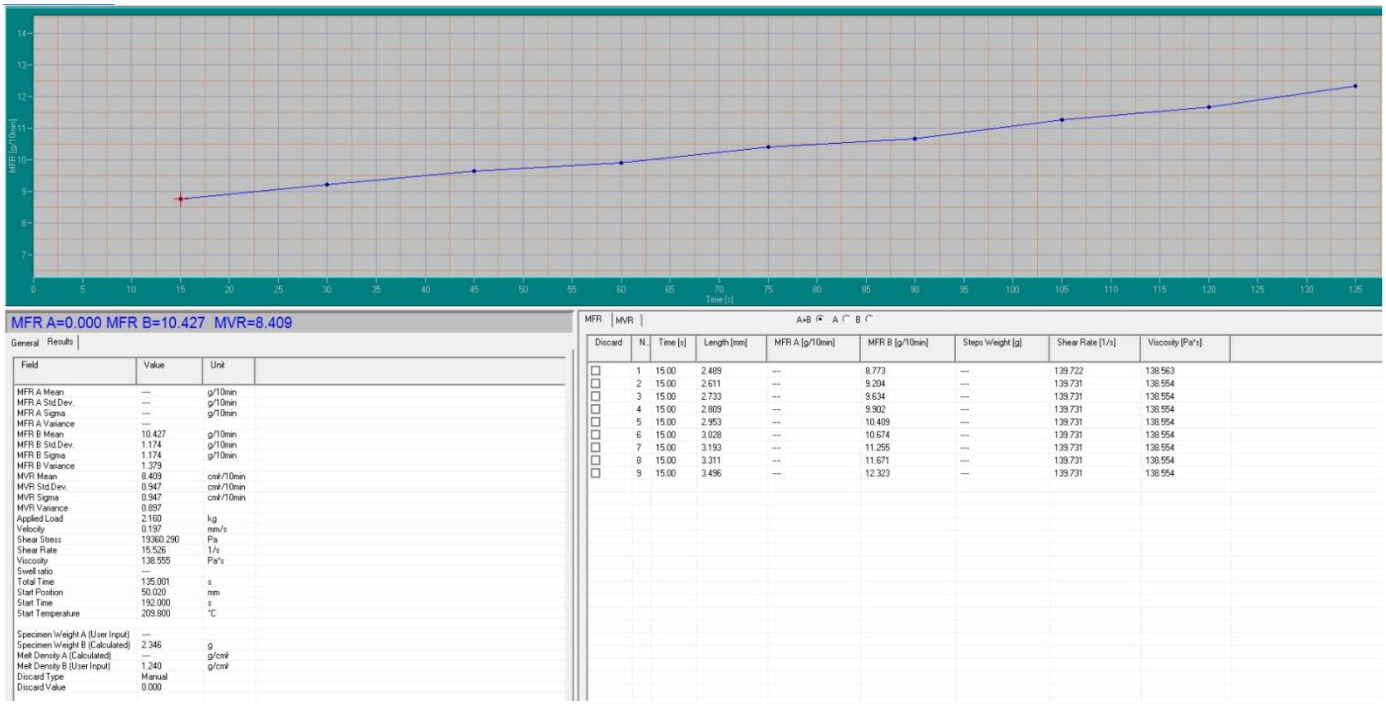
Branże, dziedziny: tworzywa sztuczne: przetwarzanie, recykling, modyfikacje.

Przykład 1: porównanie właściwości reologicznych tworzywa z taką samą zawartością % napełniaczy od różnych dostawców – dobór surowca, kontrola jakości

Przykład 2: porównanie właściwości reologicznego tworzywa w zależności od różnych zawartości % napełniacza – modyfikacje tworzyw

Zdjęcia:

Przykładowy pomiar:



Publikacje:

1. **Application of in-line rheological measurements for characterization of polypropylene/opoka rock powder composites**

[Zastosowanie pomiarów reologicznych typu in-line w charakterystyce kompozytów polipropylenu ze skałą opoka jako napełniaczem proszkowym]

Kloziński, A. , Jakubowska, P. , Przybylska, J.E. , Przekop, R.

Polimery/Polymers, Volume 64, Issue 4, 2019, Pages 282-289

Opis: The rheological properties of the composites of polypropylene (PP) with a new natural powder hybrid filler – carbonate-silicate rock called opoka – were investigated. Opoka rock is industrial waste originating (as a subsieve fraction) from the production of sorbents used in water treatment processes. The effect of opoka addition (1, 5 and 10 wt %) on the processability of PP was determined during the extrusion process using an in-line measuring stand. The testing instrument was an extruder rheometer equipped with a rheological measuring head with exchangeable dies. Cylindrical measuring dies with a radius of 1.5 mm and a length of L = 20, 30, 40 and 50 mm, respectively, were used in the measurements. The rheological parameters of the composites were determined based on the Ostwald-de-Waele power-law model at a temperature of 230 °C. The effect of the addition of opoka on the extruder operating characteristic, flow curves, viscosity curves, and the values of power law index (n), consistency factor (K), **mass flow rate (MFR)** and **volume flow rate (MVR)** have been determined.

2. **The morphological and rheological behavior of calcium carbonate nanoparticles filled virgin and waste polypropylene**

Hadi, N.J., Saad, N.A., Mohamed, D.J.

Journal of Engineering and Applied Sciences, Volume 13, Issue 24, 2018, Pages 10194-10202

Opis: This study investigated the morphological and rheological properties of Calcium Carbonate ($CaCO_3$) nanoparticles reinforce virgin Polypropylene (PP) and its waste. PP and $CaCO_3$ nanoparticles in the content of (3, 5, 7 and 10 wt.%) were mixed by melt extrusion in a twin screw extruder at different screw speeds 25 and 50 rpm at 190°C. Different microstructure and morphological techniques (X-ray diffraction and field emission scanning electron microscopy) were used to evaluate the effect of the additive percentage ($CaCO_3$) and the processing condition (screw speed) on the microstructure of the nanocomposite. The rheological behavior **(Melt Flow Rate (MFR)** and **Melt Volume Rate (MVR)**) is tested using **Melt Flow Index (MFI)** device. **MFR** of the new modified composite are tested due to the nanoparticles concentration, loads, temperatures and rotating speed while **MVR** was tested at different $CaCO_3$ nanoparticles percentage at 2.16 kg. Shear rate and viscosity are predicted according

to the **MFR** values. The results shows that the crystallinity was increasing with the $CaCO_3$ nanoparticles percentage increasing while the results of FESEM show that $CaCO_3$ nanoparticles distribution in PP matrix at 25 rpm is more homogenous and less agglomeration than at 50 rpm. The value of **MFR** and **MVR** were increasing for virgin PP while decreasing for waste PP. at 25 and 50 rpm. © Medwell Journals, 2018.

3. Effect of cold plasma treatment on recycled polyethylene/kapok composites interface adhesion

Macedo, M.J.P. , Email Author, Mattos, A.L.A. , Costa, T.H.C. , Feitor, M.C. , Ito, E.N. , Melo, J.D.D.

Composite Interfaces, Volume 26, Issue 10, 3 October 2019, Pages 871-886

Opis: Composites from recycled polyethylene and kapok fibers were prepared using untreated and plasma-treated fibers. Flow properties, mechanical properties and fracture morphology were analyzed in order to evaluate the effects of cold plasma treatment on kapok fibers to improve interfacial bonding between fibers and matrix. **Melt flow rate (MFR)** measurements indicated a reduction in flow rate of the polymer with the addition of kapok fibers. Storage modulus increased with fiber addition and this effect was more significant when plasma-treated fibers were used. Tanδ obtained from viscoelastic characterization also suggested improvements in fiber/matrix interface as a result of plasma treatment. Addition of kapok fibers to polyethylene produced a reduction in onset decomposition temperature determined from thermogravimetry curve. However, the decrease in temperature observed does not limit composite processing. Furthermore, the degree of crystallinity of polyethylene increased with the addition of untreated fibers and reduced when plasma treated fibers were added. Morphological analysis of failure surface by Field Emission Gun Scanning Electron Microscopy (FEGSEM) suggest that fiber/matrix adhesion was clearly improved when plasma treated fibers were used. Thus, the oxygen cold plasma treatment proved to be an effective non-polluting approach to enhance matrix/fiber adhesion in polyethylene/kapok fiber composites, as opposed to chemical treatments.

4. Transient simulation of pulsed purge film cooling on flow and thermal characteristics of a turbine endwall

Liu, Y., Luo, Y.Email Author

Applied Thermal Engineering, Volume 161, October 2019, Article number 114208

Opis: This paper presents influence investigation of pulsed purge film on flow and thermal characteristics of a turbine endwall. Three-dimensional transient Reynolds-averaged Navier-Stokes equations coupled with SST $k - \omega$ turbulence model are utilized in this study. Varied slot orientation angles α, mass **flow ratios (MFR)** and Strouhal (St) numbers are selected as research parameters. The results indicate that endwall film cooling effectiveness varies as orientation angle α increases. Optimum film cooling effectiveness is obtained at $\alpha = 45°$ for cosine wave injection. **MFR** increases the level of film cooling effectiveness throughout the cascade channel. At the same **MFR**, square wave injection has the worst cooling effect. In a time period, instantaneous film cooling effectiveness changes drastically. The distribution of the instantaneous film cooling effectiveness is affected by St number and cooling outflow pattern. As St increases, the laterally-averaged film cooling effectiveness changes differently for cosine and square waves in the whole cascade channel.