# Solution-processed linear methyl methacrylate-co-glycidyl methacrylate films with excellent dielectric and energy storage characters

Junhao Xie[a], Hongxu Liu[a], Jing Hu[a], Xuanchen Zhao[a], Shixin Song[b], Shulin Sun[*a], Mingyao Zhang[*a]

[a]Engineering Research Center of Synthetic Resin and Special Fiber, Ministry of Education, Changchun University of Technology, Changchun 130012, China.

[b]School of Food Science and Engineering, Jilin Agricultural University, Changchun 130012, China

The polymerization formula of PMMA and MG copolymers were listed in Table S1.

Table S1 The polymerization formula of PMMA and MG copolymers

| Designation | MMA (wt%) | GMA (wt%) | Toluene (wt%)[a] | Initiator (wt%)[a] | MMA/GMA/toluene/initiator |
|---|---|---|---|---|---|
| PMMA | 100 | 0 | 25 | 0.1 | 100/-/25/0.1 |
| MG 4 | 96 | 4 | 25 | 0.1 | 96/4/25/0.1 |
| MG 8 | 92 | 8 | 25 | 0.1 | 92/8/25/0.1 |
| MG 12 | 88 | 12 | 25 | 0.1 | 88/12/25/0.1 |

[a] The percentage content of toluene and initiator was calculated according to the total mass of MMA and GMA.

**Composition calculation of the MG copolymers**

In this experiment, the internal standard method was used to test the content of GMA in the copolymer. The internal standard method is the most commonly used method in quantitative analysis. The content of the copolymer unit can be derived from the following equation:

$$\frac{A_r}{n_r} \times \frac{m_s}{M_s} = \frac{A_s}{n_s} \times \frac{m_r}{M_r} \tag{1}$$

where $A_s$ is the integrated area of the quantitative peak of the measured copolymer , $n_s$ is the number of protons contained in the quantitative peak of the measured copolymer, $M_s$ is the molecular mass of the measured copolymer, $m_s$ is the mass of the measured copolymer, $A_r$ is the integrated area of the quantitative peak of the measured copolymer, $n_r$ is the number of protons contained in the quantitative peak of the measured copolymer, $M_r$ is the molecular mass of the measured copolymer and $m_r$ is the mass of the measured copolymer. Thus, we can find the molar content of the copolymer unit in the copolymer from the integrated area on the $^1$H NMR spectrum molar content of the copolymer.

As can be seen in Figure S1, three peaks appear at 2.66, 2.87 and 3.23 ppm

corresponding to the H characteristic displacement peaks on the epoxy group of GMA. And the peak at 3.60 ppm is the H characteristic shift on the methoxy groups of MMA. Therefore, using the peak areas of the corresponding characteristic peaks in the MG copolymer and Equation S1, we can easily calculate the molar content of the copolymer components in the copolymer. The calculation results of GMA component in the MG copolymers can be found in Table 1, which is 2.2 mol% for MG4, 5.3 mol% for MG8, and 8.2 mol% for MG12.
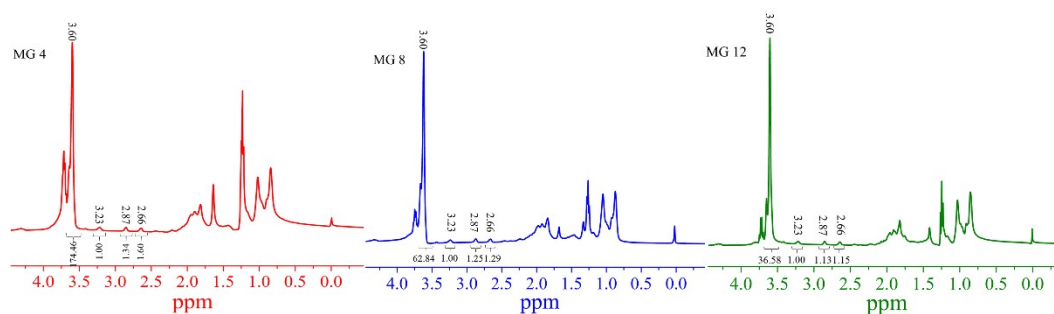


Figure S1 ^{1}H NMR of MG copolymers