# 7. Number Average MW, Weight Average MW, Viscosity Average MW

## NUMBER AVERAGE MOLECULAR WEIGHT $(\bar{M}_n)$

$$\bar{M}_n = \frac{n_1 m_1 + n_2 m_2 + \dots + n_i m_i}{n_1 + n_2 + \dots + n_i}$$

$$\bar{M}_n = \frac{\sum n_i m_i}{\sum n_i}$$

## WEIGHT AVERAGE MOLECULAR WEIGHT $(\bar{M}_w)$

$$\bar{M}_w = \frac{w_1 m_1 + w_2 m_2 + \dots + w_i m_i}{w_1 + w_2 + \dots + w_i}$$

Here, $w = nm$. Thus,

$$\bar{M}_w = \frac{n_1 m_1^2 + n_2 m_2^2 + \dots + n_i m_i^2}{n_1 m_1 + n_2 m_2 + \dots + n_i m_i}$$

$$\bar{M}_w = \frac{\sum n_i m_i^2}{\sum n_i m_i}$$

## VISCOSITY AVERAGE MOLECULAR WEIGHT $(\bar{M}_v)$

$$\bar{M}_v = \left( \frac{n_1 (m_1)^{1+a} + n_2 (m_2)^{1+a} + \dots + n_i (m_i)^{1+a}}{n_1 m_1 + n_2 m_2 + \dots + n_i m_i} \right)^{\frac{1}{a}}$$

$$\bar{M}_v = \left( \frac{\sum n_i (m_i)^{1+a}}{\sum n_i m_i} \right)^{\frac{1}{a}}$$

$$\overline{M}_w > \overline{M}_v > \overline{M}_n$$

$$\text{Poly Dispersary Index (PDI)} = \frac{\overline{M}_w}{\overline{M}_n}$$

## LKG PROBLEMS

① Calculate $\overline{M}_n, \overline{M}_w, \overline{M}_v$ and PDI in a polymer with $a = 0.64$ and given:

$$10 \text{ molecules} \longrightarrow 5000 \text{ u}$$
$$20 \text{ molecules} \longrightarrow 7500 \text{ u}$$
$$25 \text{ molecules} \longrightarrow 15000 \text{ u}$$
$$40 \text{ molecules} \longrightarrow 25000 \text{ u}$$

② Calculate $\overline{M}_n, \overline{M}_w, \overline{M}_v$ and PDI in a polymer with $a = 0.65$ and given:

$$25 \text{ molecules} \longrightarrow 3000 \text{ u}$$
$$50 \text{ molecules} \longrightarrow 6000 \text{ u}$$
$$40 \text{ molecules} \longrightarrow 5000 \text{ u}$$