# CHAPTER V

# CONCLUSIONS

The free-volume theory is mainly used to explain the effect of aging on polymer materials. We find the applicability of the equation $\varepsilon(t) = \varepsilon(0) \exp [(t/t_0)^{\beta}]$.

For the effect of time, during aging, Young's modulus (E) and retardation time ($t_0$), also $<\tau>$, increase as the aging time increases because of low $V_f$ and molecular mobility.

For the effect of polymer concentrations, we demonstrated that E, $t_0$, $<\tau>$ and $\mu$ increase with the % PPO. This results from the effects of chemical structure, flexibility of polymer chain, mobility and free volume.

For the effect of temperature, the change in temperature affects mobility and $V_f$, as mentioned above. So modulus, $t_0$, $<\tau>$ and $\mu$ vary with the aging temperature. E, $t_0$ and $<\tau>$ decrease as the aging temperature increases. In the temperature aging window $T_\beta<T_1<T_g$, as $T_1$ increases $\mu$ first increases from zero to a maximum about unity and then decreases to zero at $T_g$. At low temperatures, finally, the aging begins to cease, and $\mu$ decreases.