CHAPTER V

CONCLUSION

Polymers bearing 4-chloro-2,5-diphenyloxazole in the main chain and as a pendent chain were synthesized and characterized. The appropriate monomers were designed, mono-functionalized monomers for polymers containing 4-chloro-2,5-diphenyloxazole in side chain and di-functionalized monomers for polymers containing 4-chloro-2,5-diphenyloxazole in main chain.

To construct mono-functionalized monomers, the 4-(4′-chloro-5′-phenyloxazol-2′-yl)phenyl]methyl methacrylate derivatives was prepared by a three steps reaction. The synthetic route firstly started from the preparation of 4-(4′-chloro-5′-phenyl-oxazol-2′-yl)-benzaldehyde derivatives by using modification of Fischer synthesis. The effect of substituent groups either electron donating or electron withdrawing groups suggested that the plausible mechanism of this reaction occurs via the corresponding acylimidoyl chloride. Then, the aldehyde group was reduced to alcohol by using sodium borohydride. Finally, this alcohol was reacted with methyl methacryloyl chloride to give a desired monomer.

To obtained di-functionalized monomer contain 4-chloro-2,5-diphenyloxazole, 4-chloro-2,5-bis-(4-fluorophenyl)oxazole was prepared in two steps starting from 4-fluorobenzoyl chloride. First, 4-fluorobenzoyl chloride was treated with CuCN in acetonitrile to prepare 4-fluorobenzoyl cyanide (yield 85%). In the next step, the prepared 4-fluorobenzoyl cyanide was reacted with 4-fluorobenzaldehyde to obtain 4-chloro-2,5-bis-(4′-fluorophenyl)oxazole monomer.

In term of free radical polymers, acrylate monomers with various substituents including H, F, OCH_3, NO_2 and NH_2 were copolymerized with MMA in a different feed ratio, 1% and 5%. These polymers showed a thermal stability in the range of 247-280^{o}C due to strong dipolar interactions in the solid state between 4-chloro-2,5-diphenyloxazole moiety in the polymer side chains. The *Tg* valued in the range of

114-128°C and only one transition was observed. Thus, these polymers are substantially amorphous in the solid state.

4-Chloro-2,5-bis-(4′-fluorophenyl)oxazole monomer was condensed with bisphenol A to construct a poly(aryl ether). The optimum polymerization time to obtain a high molecular weight was around 9 h. These poly(aryl ether)s exhibited an excellent thermal stability ranging from 334-364°C and *Tg* valued in the range of 192-205°C. Both polymers show a good solubility in a number of common organic solvents.

These two types of polymers containing 4-chloro-2,5-diphenyloxazole have been evaluated the optical properties. All polymer showed the maximum absorption and emission band in the same range as 4-chloro-2,5-diphenyloxazole, parent molecule. Introducing of methoxy and nitro substituents shifted the position of maximum absorption and emission spectrum bathochromically. The photophysical spectra of the polymer in solid state are similar to those in solution, this indicates that their conformation in a solid phase is not greatly changed in comparison with those in a solution phase and they do not show the new emission band in longer wavelength due to an excimer formation. The highest fluorescent quantum yield was observed for **[P1]**, $\phi_f = 0.62$. These polymers are high band gap materials of 2.99-3.44 eV.

The scintillation efficiency in these system is highly dependent upon the type of chemical functionality attached at the 2,5-diphenyloxazole, fluorescence quantum yield and geometry conformer. 4-(4′-Chloro-5′-phenyloxazol-2′-yl)phenyl]methyl methacrylate exhibited highest scintillation counting and several thousand times higher than 2,5-diphenyloxazole. It is interesting to note that even polymer containing 1% of scintillating unit can detect the ionizing radiation. Therefore, this polymer can be served as an alternative scintillation detector. Further investigations are in progress to measure and improve these materials.