SUMMARY

The present work involves three sections:-

1- Preparation of some resins of expected fire retardant properties such as thiourea-formaldehyde resin (TUF) based on a polycondensation reaction between thiourea (TU) and formaldehyde (F) in alkaline media.

Preparation of unsaturated polyester (PE) resins (containing halogen) based on the polyesterification reaction between phthalic or tetrabromophthalic anhydride, maleic anhydride and ethylene glycol, then the prepared (PE) resins admixed with 30 Wt.% of styrene (St) monomer.

Preparation of N-methacryloyloxyphthalimide (NMP), N-methacryloyloxytetrabromophthalimide (NMTP) through the reaction of N-hydroxyphthalimide or N-hydroxytetrabromophthal-imide with methacryloyl chloride in presence of triethylamine (Et_3N) or with methacrylic acid in presence of N,N`-dicyclohexyl-carbodiimide (DCCI). Then the prepared acrylic monomers were copolymerized with methylmethacrylate (MMA) monomer in solution in the presence of benzoyl peroxide (Bz_2O_2) as initiator.

2- Impregnating and coating the white pine wood with the prepared resins, monomer mixtures and copolymers, to give wood polymer composites.

3- Measurements were done on the treated and untreated wood samples to determine the development in physical and mechanical properties. Also fire-retarding properties of the treated and untreated wood samples and of the prepared plastic sheets were investigated based on ASTM standards.

In a two successive vacuum impregnation processes, wood samples were impregnated with (TUF) resin and orthophosphoric acid (OPA) solutions at different concentrations. Water Repellent Effectiveness (WRE) and Antiswelling Efficiency (ASE) values were greatly improved for all treated wood samples compared to untreated wood samples especially for those with 85% OPA.

Compression strength in both directions (parallel and perpendicular to grain) were carried out and a maximum value obtained for treated wood samples with 70% OPA. Also fire-retardancy of all treated wood samples was greatly improved. The best results obtained for samples, which has grain in smallest dimension due to the greater cell wall number for absorbing impregnant solution.

Impregnation of samples with PE/St resins (of various bromine contents), subsequent curing by Bz_2O_2-heat technique, gives wood plastic combination (wpc) with greatly enhanced physical properties. Maximum values of percent retention, wood polymer gain, crosslinking, water uptake percent and compression strength (in both directions) were obtained for wood samples

impregnated with PE/St resin of zero bromine content. The highest value of WRE is obtained for wood samples impregnated by PE/St resin of the lowest bromine content, whereas maximum ASE value is obtained for wood samples impregnated by PE/St resin of highest bromine content. Coated wood sheets by PE/St resin of highest bromine content classified as a self-extinguishing substance, also all plastic sheets containing bromine were judged as self-extinguishing substances while the free-bromine sample was judged as a burning substance. In addition, fire-retardancy of the coated wood samples was improved more than the impregnated wood samples.

The same behavior may be obtained for the wood samples impregnated by (NMP/MMA) and (NMTP/MMA) comonomer mixtures, subsequently polymerized by initiator-heat technique. The highest value of weight percent gain (WPG) was obtained for the impregnated wood samples with a free bromine comonomer mixture. Average volume change decreases by increasing bromine content in the comonomer mixture. WRE has its highest value for the impregnated wood samples with a free bromine comonomer mixture. Resistance to swelling (measured by ASE values) was improved for all treated wood samples especially for free bromine comonomer mixture.

Also compression strength has its highest value for impregnated wood samples with comonomer mixture of zero bromine content but the excellent fire retarding properties were

obtained for wood samples impregnated by comonomer mixture of highest bromine content.

Finally, it was found that a parallel relation between the above results obtained for wood samples impregnated with mixtures of methyl methacrylate and phthalimide monomers and the wood samples impregnated with the copolymers of the corresponding comonomer mixtures.