the PCM material, is the relevant indicator of its potential for thermal storage.

## Examples of PCM Incorporated in Common Building Elements

Shapiro et al. (1987) from Concordia University in Quebec have developed and tested wallboards impregnated with organic fatty acids. No exudation of liquid PCM occurred below 25% (by weight) of the PCM. The wallboards, 1/2" thick, had a total heat capacit of about 30 Btu/sf with temperature swing of 4 oC (7 oF), namely about three times the heat capacity of concrete tiles of the same thickness. The organic PCM have been diffused into conventional wallboard's materials such as gypsum (30% by volume).

Salyer and his colleagues (1985) from the University of Dayton, Ohio are developing, under a contract with the DOE, and have applied for patents, passive storage systems incorporating PCM into such materials and building elements as cement, concrete, plaster, plasterboard, tiles, etc. The PCM they are recommending are mainly crystalline alkyl hydrocarbons (paraffin waxes).

These PCM are by-products of oil refining, readily available and quite inexpensive. They can be formulated to melt and freeze at any desired temperature, from about 50 °F (10 °C) up to 120 °F (50 °C). For passive solar applications a transition temperature of about 77 °F (25 °C) would be the most likely.

The waxes have heat of fusion of 70-110 Btu/lb. (40-60 cal/gm). Salyer and Miller mention that the waxes can be applied to the building materials in various ways, for example:

- Adding directly to the wet mix of the cementious materials up to about 5% in weight. However, in this form of application the strength of the concrete is reduced considerably.
- Wax PCM in liquid state can be directly percolated into the open spaces of porous building materials, such as concrete, plaster, bricks, etc.. This form of application also waterproofs the material.
- The PCM can be processed into small hard expanded pellets, containing about 80% PCM. These pellets can be incorporated into the wet mix, as aggregates, with minimum reduction in strength.

Salyer and his colleagues (1985) have reported that they succeeded in producing hard pellets containing 80% wax PCM, imbibed into high density polyethylene (HDPE), which store and release the energy at about the same temperature as the pure PCM. They suggest several applications of these pellets:

- Using them as aggregates in the mix of concrete.
- Incorporation into other media such as polystyrene bead foam insulation.
- Incorporation into thermosetting or thermoplastic composites.
- A PCM pellets bed heat exchanger, with air or liquid circulation.