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Terminology for high temperature pressing

Scope

This TIP provides clarification and definition of terms currently in use in the area of high temperature pressing.

Safety precautions

This TIP deals with terminology only; no information on safety precautions is provided.

Terminology for high temperature pressing

Apparent density: the apparent weight per unit volume. It is often calculated by dividing the basis weight by the thickness. The units are kg/m^3 .

Condebelt: web is dried between 2 steel belts – one of which is heated and the other cooled – instead of traditional steam cylinders (1). The top band is heated by steam and the bottom band is cooled by water. Trademark of Metso.

Critical delamination energy: energy input to the sheet above which delamination occurs during high temperature pressing (2). Affected by sheet furnish, basis weight and thermal properties of the roll surface materials.

Critical delamination temperature: hot roll (or platen) temperature above which sheet delamination occurs during high temperature pressing (3).

Crushing: wet pressing-related phenomena where hydraulic shear forces exceed fiber network shear strength, causing disruptions in sheet structure (4). (Can be caused by application of excessive pressure during an early stage of pressing.)

Darcian permeability: constant K in the equation $v = K\Delta P/\mu L$, where v is the superficial velocity (flow rate divided by area) (m/s), μ is the fluid viscosity (Ns/m^2), and ΔP is the pressure drop (Pa) in the flow direction across a distance L , and L is the length (m) (5). The units of K are m^2 .

Delamination: in-plane fracture of the sheet-; e.g., delamination of plies (6). Small scale delamination can be detected using out-of-plane ultrasonic stiffness measurements.

Displacement dewatering: dewatering process using pressurized air or steam phase to expel free liquid water from paper while the paper is simultaneously under mechanical pressure (7).

Effective thermal diffusivity (of roll coating): empirically-determined value of a single-layered diffusivity that is equivalent to the true thermal diffusivity of a multi-layered coating (8). The units are m^2/s .

Gas heating: method of heating where combustion of gas, e.g., natural gas, is used as an energy source.

Glazing of fabric surface: a press felt surface condition (melting of the surface fibers) that may result from felt fabric contacting with an overheated dryer or heated roller; such surface condition may reduce the permeability of the felt and lower the dewatering rate of the sheet.

High intensity pressing (not hot): a wet pressing operation in which a shoe press or highly loaded roll press with large diameter rolls is used to obtain higher levels of press impulse (9).

High temperature pressing: the process of enhancing mechanical water removal in the press by increasing the sheet temperature above 100°C, including use of impulse drying or press drying (10).

Hot oil heating: a heating system using hot oil as a heat transfer mediator to supply heat to the pressing or drying system.

Hot pressing: process of enhancing mechanical water removal in the press by increasing the sheet temperature (below 100°C), including use of steam showers or infrared heaters in press section or use of non-contact steam (Tem-Sec press) (10,11).

HTP press: dewatering process in which a shoe press is used to obtain high press impulse levels against a very hot mating roll. Trademark of Beloit Corporation.

Hydra-Nip drying: process using Hydra-Nip dryers (rubber covered rolls loaded against special dryers) at a pre-determined or controlled sheet moisture content (12). Trademark of GL&V/Black Clawson-Kennedy.

Impulse: the product of the average pressure and the time during which it acts (13). Also equal to the ratio of the nip load (force per unit width) to the machine speed. The units are MPa•s.

Impulse Drying: process using a press-nip with one hot roll to remove water from a wet paper web (1). Z-direction compressive pressures up to 5 MPa and hot surface temperatures up to 500°C are used in this method.

Induction heating: method of heating by creating eddy currents in the roll surface using variable frequency or DC electromagnets placed near the roll shell (14).

Infrared heating: method of heating using absorption of infrared radiation (15). The infrared emitters may be powered by electricity, natural gas, or any other power source which delivers heat at sufficient temperature to cause radiant emission in the infrared spectrum. Infrared heater temperature and sheet moisture content affect the efficiency of infrared heating (16, 17).

Kinematic viscosity: $\nu = \mu / \rho$ where μ is the fluid's dynamic viscosity (kg/ms) and ρ the fluid density (kg/m³) (18). The units are m²/s.

Lateral permeability: $K_r \equiv (K_x + K_y)/2 = [Q\mu \ln(R_o/R_i)]/(2\pi L\Delta P)$ where Q is the volumetric flow rate (m³/s) based on the motion of the meniscus in the fluid supply tubing, μ is the fluid viscosity (Ns/m²), R_o is the outer radius of the sheet (m), R_i is the radius of the injection port (m), L is the sheet thickness (m), and ΔP is the pressure drop (Pa) from the fluid injection port to the edge of the sheet (5). The units of K_r are m².

Lazy steam: non-turbulent steam vapor-air mixture produced by dampening the velocity of high pressure steam as it exits the drilled holes of a header (19). Trademark of Wells Enterprises, Inc.

Lazy steam showers: profiling or preheating steam showers that apply non-turbulent low pressure steam to the sheet (20).

Moisture content, air-dry (a.d.) basis: ratio of the weight of water to the total weight of the sheet (including moisture) at 50% relative humidity (21).