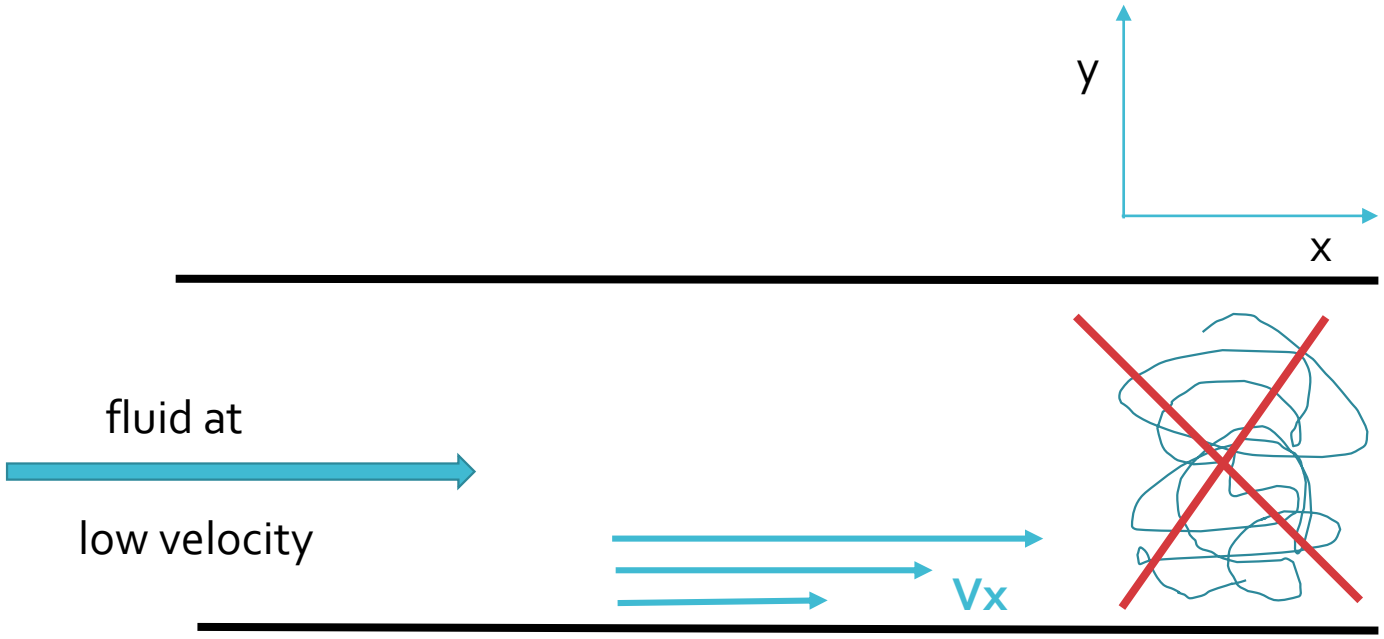
2.WEEK

CHE 212 FLUID MECHANICS

Assoc.Prof. Dr. Ayşe Karakeçili

Ankara University
Chemical Engineering Department

MOMENTUM TRANSPORT and NEWTON's LAW OF VISCOSITY



At low velocities fluids tend to flow without lateral mixing and ADJACENT LAYERS.

The velocity Vx in x direction decreases as we approach the surface of the pipe in y direction.

MOMENTUM TRANSPORT and NEWTON's LAW OF VISCOSITY

The moving fluid posses some momentum and transport this momentum to the upper layer. The upper layer receives the momentum and starts to move at a slightly slower velocity.

Each layer is dragged along by the layer below it and moves at a slower velocity as we go up in y-direction.

Momentum is transferred from a region of high fluid velocity to one of low velocity.

MOMENTUM TRANSPORT and NEWTON's LAW OF VISCOSITY

- F/A is directly proportional to dV_x / dy
- The proportionality constant is called the VISCOSITY of the fluid
- $F/A = -\mu \, dV_x / dy$

MOMENTUM TRANSPORT and NEWTON's LAW OF VISCOSITY

- Force per area is defined as the SHEAR STRESS or SHEAR FORCE and is denoted with τ

- $\tau_{yx} = -\mu \, dV_x / dy$  NEWTON's LAW OF VISCOSITY

MOMENTUM TRANSPORT and NEWTON's LAW OF VISCOSITY

- A fluid whwn subjected to an applied stress will continuely deform, i.e. Flow at a velocity that increases with increasing stress. The fluid exhibits resistance to this stress.

- Viscosity, is that property of fluid which gives rise to forces that resist the relative movement of adjacent layers in the fluid.

MOMENTUM TRANSPORT and NEWTON's LAW OF VISCOSITY

- Fluids that follow the Newton's Law of viscosity are called Newtonian Fluids

- Fluids those do not follow this behavior is called non-Newtonian Fluids.