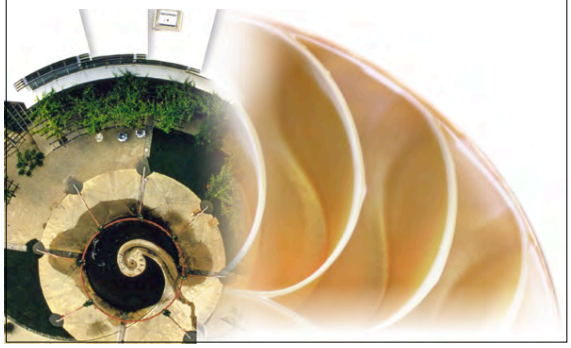
Glass and Light

ARCH 331/431 Spring 2008
Lecture 17



Glass Envelopes and High Performance Buildings

Selecting the right glass for a project has far-reaching implications for the performance of a building and the comfort of its users.

The following six issues should be considered when selecting the glazing for a project:

1. **Winter Comfort and Heating Load**
2. **Summer Comfort Cooling Load**
3. **Natural Daylighting**
4. **Appearance and Reflectivity**
5. **Ultraviolet Fading Control**
6. **Condensation Control**

HEAT & LIGHT: Glass in Small versus Large Buildings

RESIDENTIAL (SMALL BUILDINGS)

Glass should:

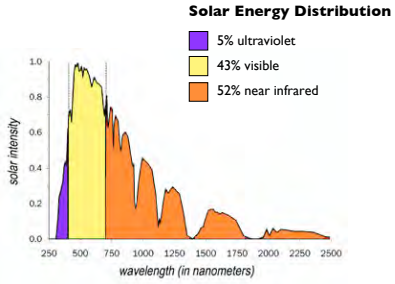
- keep the heat in during the winter
- maximize the transfer of solar energy in the winter
- minimize the transfer of solar energy and heat in the summer

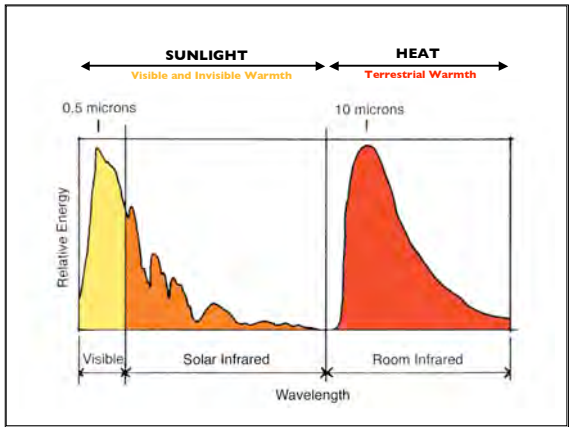
COMMERCIAL (LARGE BUILDINGS)

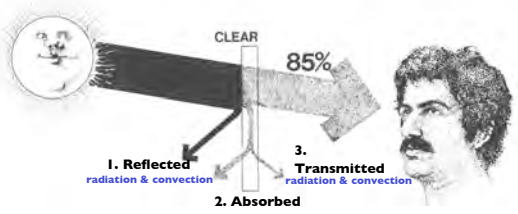
Glass should:

- minimize the transfer of solar energy and heat most of the time
- maximize the transfer of light into the building

Solar Energy Distribution





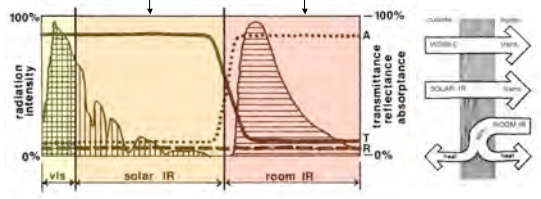


Reflected	**(R)**		**x%**
Absorbed	**(A)**	**+**	**x%**
Transmitted	**(T)**	**+**	**x%**
	Total	**= 1.00**	**(100%)**

1. CLEAR GLASS

Highly **transparent** to solar energy (visible & solar IR)

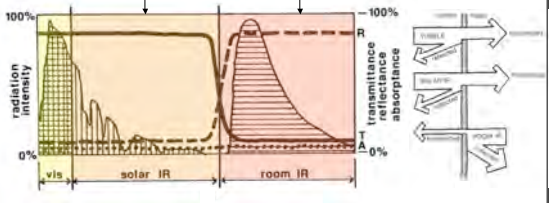
Nearly opaque to room IR: ~90% of room heat is **absorbed** and then radiated/convected to either side (low transmittance and reflectance)



2. RESIDENTIAL LOW-E ("heat mirror" film)

~85% **transparent** to solar energy (visible & solar IR); ~6% is absorbed and ~9% is reflected

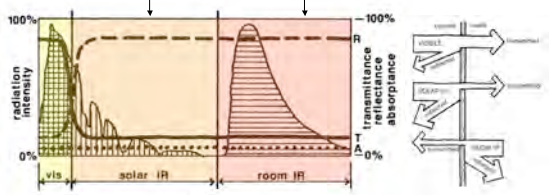
Highly **reflective** to room IR room heat: ~85% room heat is reflected back into the space (low transmittance and absorptance)



3. COMMERCIAL LOW-E ("heat mirror" film)

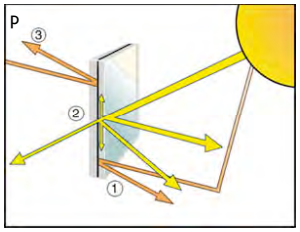
~85% **transparent** to VISIBLE energy, ~10% transparent to solar IR; ~10% reflective to visible energy, ~85% **reflective** to SOLAR IR

Highly **reflective** to room IR room heat: ~85% room heat is reflected back into the space (low transmittance and absorptance)



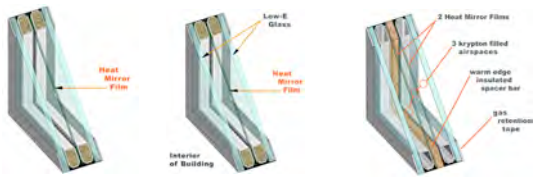
LOW-E (low emissivity) GLAZING

A very thin metallic coating applied to a glass surface or film has the effect of reflecting long-wave radiation, either the warmth from inside a space (winter) or warmth from the exterior of a building (summer).



1. Heat (warmth from outside air) is reduced
2. Reflected visible and solar IR radiation
3. Interior heat is reflected back inside

Southwall™ Glazing Systems



Heat Mirror Insulating Glass | **Heat Mirror Plus Insulating Glass** | **Superglass System™**

The Heat Mirror is a low-emissivity coated film product suspended inside an insulating glass unit. The result is a triple unit with two airspace's without the weight of triple insulating glass and with far superior insulating and shading performance.

There are many different The Heat Mirror coatings ranging from HM 88 (highest shading coefficient/highest solar transmittance) to HM 22 (lowest shading coefficient/lowest solar transmittance).

INSULATING PERFORMANCE

TERMS

Solar Heat Gain Coefficient (SHGC):	The ratio of total transmitted solar heat to incident solar energy.
Shading Coefficient (SC):	Largely replaced by SHGC, this older measure is the ratio of solar gain of a particular glazing as compared to a benchmark glazing (1/8" clear glass) under identical conditions.
Visible or Daylight Transmittance:	The percentage of visible light striking the glazing that will pass through. Glass with high values appear clear; Glass with low values appear dark.
Solar Transmittance:	The percentage of (invisible) solar IR that will pass through.
Visible or Daylight Reflectance:	The percentage of visible light reflected by the glazing.
Solar Reflectance:	The percentage of (invisible) solar IR reflected by the glazing.
U-value (BTU/hr ft^2 °F):	The heat transfer coefficient through the glazing (lower values indicate less heat transfer/better insulation value).