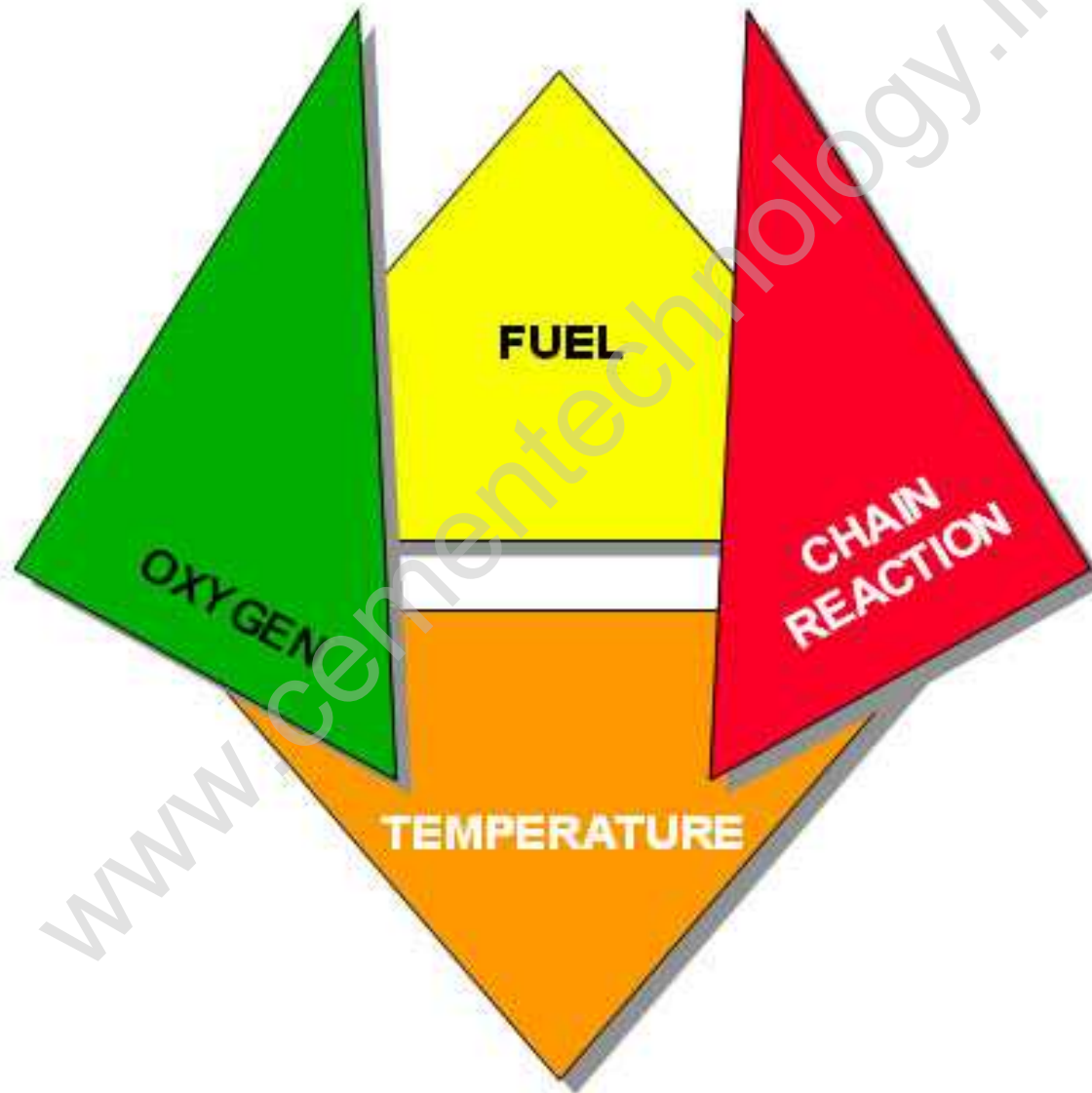




The Combustion Process

THE FIRE TETRAHEDRON



The combustion process


combustion = Reducing agent + oxidizing agent + ignition source

سوخت

اکسیژن


Fire Classes

A Trash Wood Paper




- wood
- cloth
- paper
- rubber
- many plastics

C Electrical Equipment




- energized electrical equipment

B Liquids Grease



- gasoline
- oil
- grease
- tar
- oil-based paint
- lacquer
- flammable gases

D COMBUSTIBLE METALS



- magnesium
- sodium
- potassium
- titanium
- zirconium
- other flammable metals

Ignition source at process plant

1. Flames
2. Hot work
3. Hot surfaces
4. Hot particles
5. Friction and impact
6. Chemical Energy
7. Hot material and gases
8. Reactive ,unstable and pyrophoric material

Ignition source at process plant

9.Engines

10.Vehicle

11.Lightning

12.Radio frequency transmissions

13.Smoking

14.Arson

15.Self-heating

16.Static electricity $E = 0.5CV^2$

17.Electrical equipment $E = I^2 RT$

18.Autoignition

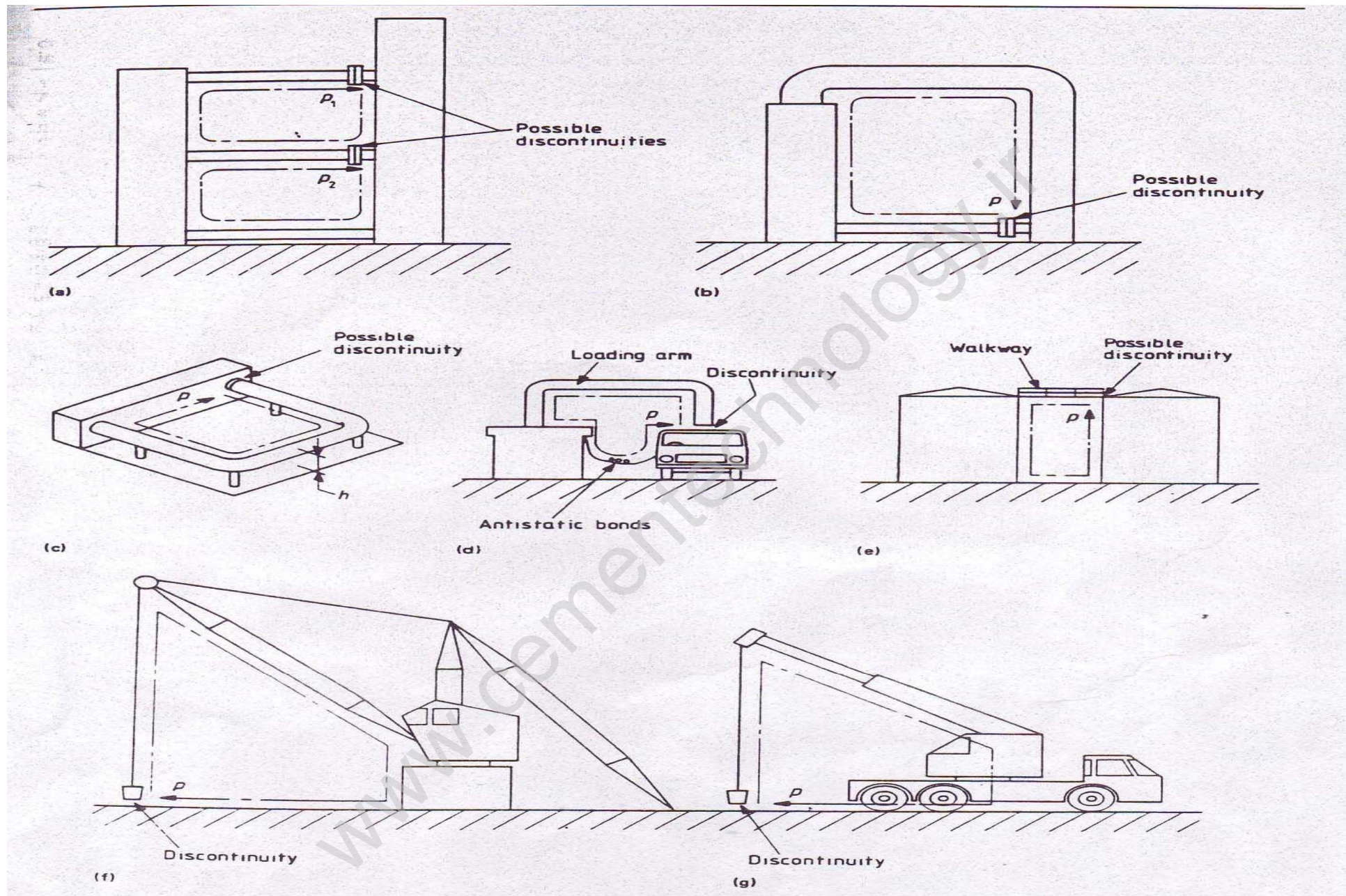


Figure 16.34 Some typical loop-type structures for RF ignition (BS 6656: 1991): (a) loop formed by columns and pipes; (b) loop formed by columns and pipes; (c) horizontal loop; (d) tanker loading facility; (e) storage tanks; (f) fixed crane; and (g) mobile crane. h , Height of loops; p , internal perimeter of loop (Courtesy of the British Standards Institution)

ویژگیهای اشتعال

Flash point :

$$T_f(c) = 0.683 (t_b) - 71.7$$

Fire point :

Auto ignition temperature (AIT) :

عواملی که باعث کاهش دمای خود سوزی میشود:

اثر کاتالیستی |

حجم |

غلظت اکسیژن |

Flammability limit

محاسبه محدوده اشتعال:

(۱) فرمول Jones

$$LFL = 0.55C_{est}$$

$$UFL = 3.5C_{est}$$

C_{est} = Stoichiometric Concentration

۲) فرمول spakowski

$$LFL = 4354 / (- \Delta H)$$

$$\Delta H = \text{kJ/mol}$$

اصلاح برای محدوده قابل اشتعال

۱. تصحیح دمایی

$$LFL(t) = LFL(25c) \{ 1 - 0.75(t-25) \} / -\Delta H$$

$$\Delta H = \text{cal/mol}$$

۲. تصحیح فشار

$$UFL = UFL(1\text{atm}) + 20.6(\log P + 1)$$

$$P = \text{Mpa}$$

۳. غلظت اکسیژن

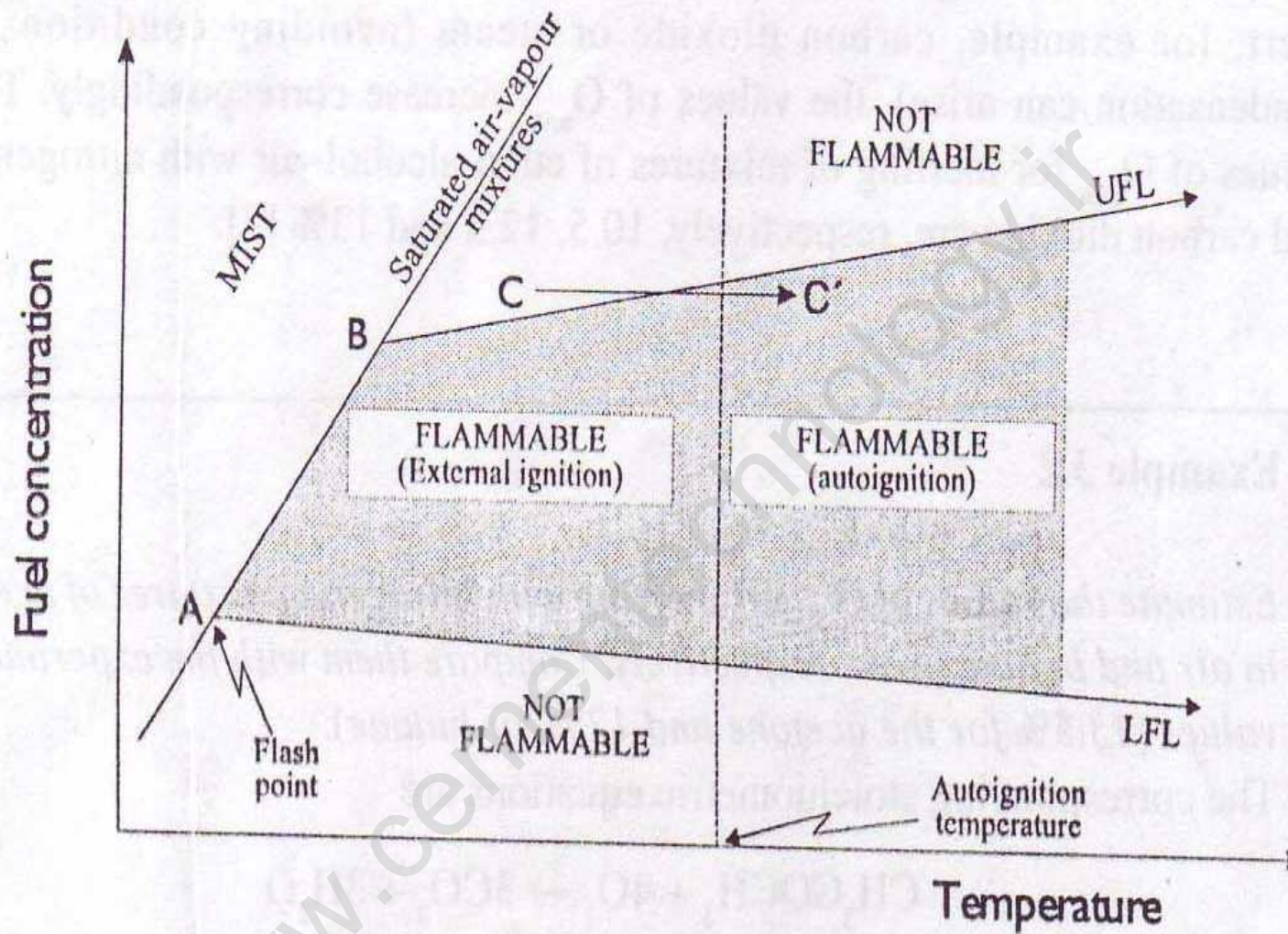


Figure 3.2 Concentration-temperature diagram showing different flammability characteristics. UFL = upper flammability limit; LFL = lower flammability limit.