ME 6163: Combustion Engineering

The followings are some generalized statements regarding combustion. You should be able to explain them precisely (using less than 5 sentences).

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1. Strongly coupled chemical reaction, fluid flow, heat and mass transfer affect flame propagation.
2. Flame propagation in engines are inherently turbulent and unsteady.
3. Turbulent flames propagate faster than laminar flames.
4. Flame wrinkling increases mass-burning rates.
5. Exhaust from gas turbines are very hot as compared to engine exhausts.
6. SI engine exhaust is hotter than CI engine exhaust.
7. Wood burning is a slow and low-temperature combustion.
8. Typical engine fuels are in general blend of many hydrocarbons, rather than a pure one.
9. Exhaust gases from power-plant are hotter than 120^oC.
10. $HHV - LHV = \begin{cases} min. & \text{for Carbon,} \\ max. & \text{for Hydrogen.} \end{cases}$
11. Ethanol has significantly lower heating value than gasoline, yet engine power is comparable when it is used.
12. T_{ad} for octane is 2350 K, but 2750 K may reach in SIE combustion.
13. T_{ad} for constant volume combustion is higher than isobaric combustion.
14. Maximum T_{ad} for HC combustion occurs at slightly rich condition.
15. Increase in pressure leads to higher flame temperature.
16. Increase in pressure leads to higher burning rate.
17. At very low pressure, combustion reaction rate is low.
18. At very high pressure, combustion reaction rate may also be low.

19. Adding inert gases may reduce combustion reaction rate.

20. 50% methane-air is a safe gaseous mixture against explosion.

21. SI engine exhaust gases are hotter than CIE exhaust gases.

22. Gas turbine exhaust gases are hotter than SIE exhaust gases.

23. Lean burning results in lower NOx formation.

24. CIE exhaust contains more moisture than SIE exhaust.

25. CO_2 is not considered as combustion emission.

26. Hot engine exhaust contains CO emission even with lean burning.

27. Hot engine exhaust contains H_2 emission even with lean burning.

28. Don't expect to find CH_4 in rich-burning engine fuelled by CH_4.

29. HC formation is a problem for CIE.

30. Mixing small water with diesel may improve combustion and emission conditions.

31. Catalytic converters are ineffective in early stage of driving.

32. CO is very deadly.

33. Wood burning is significantly different than coal burning.

34. Candle burning is significantly different than coal burning.

35. Coal burning process is slow.

36. Coal combustion yields comparatively low temperature.

37. Lambda control is very important for proper functioning of catalytic-converters.

38. Spark timing is advanced more for lean mixtures in SI engines.

39. Spark timing is advanced more at higher engine speeds in SI engines.

40. Knocking more likely to occur with lean mixtures in SI engines.

41. SI engines are high speed engines.

42. Flame speed of a combustible mixture may be zero, but not the burning velocity.

43. Flame anchors itself to mixture where $\phi = 1.0$.

44. Unique definition of laminar flame thickness is not available.

45. Increase in mixture temperature reduces flame thickness.

46. Turbulence length scales are very important in turbulent burning.

47. Candle flame assumes different shape in microgravity.

48. Mass diffusion rate is important both in premixed and non-premixed flames.

49. Soots are generally formed in non-premixed combustion.

50. Combustion is characterised by exothermic reactions.