Fire spread in ventilated facades - The leap-frog effect

A large growth is expected in the global facade market in the coming years, and the fastest growing segment is ventilated facades.

Because of several large façade fires in the last years there is a strong focus on fire safety of façades.

Fire in Grenfell Tower

Four majors fires that has been widely discussed are the Grenfell Tower in London, the Downtown fire in Dubai, the Torre dei Moro building in Milan and the Lacrosse fire in Melbourne.
The predominantly used cladding materials have been metal composite materials (MCM).

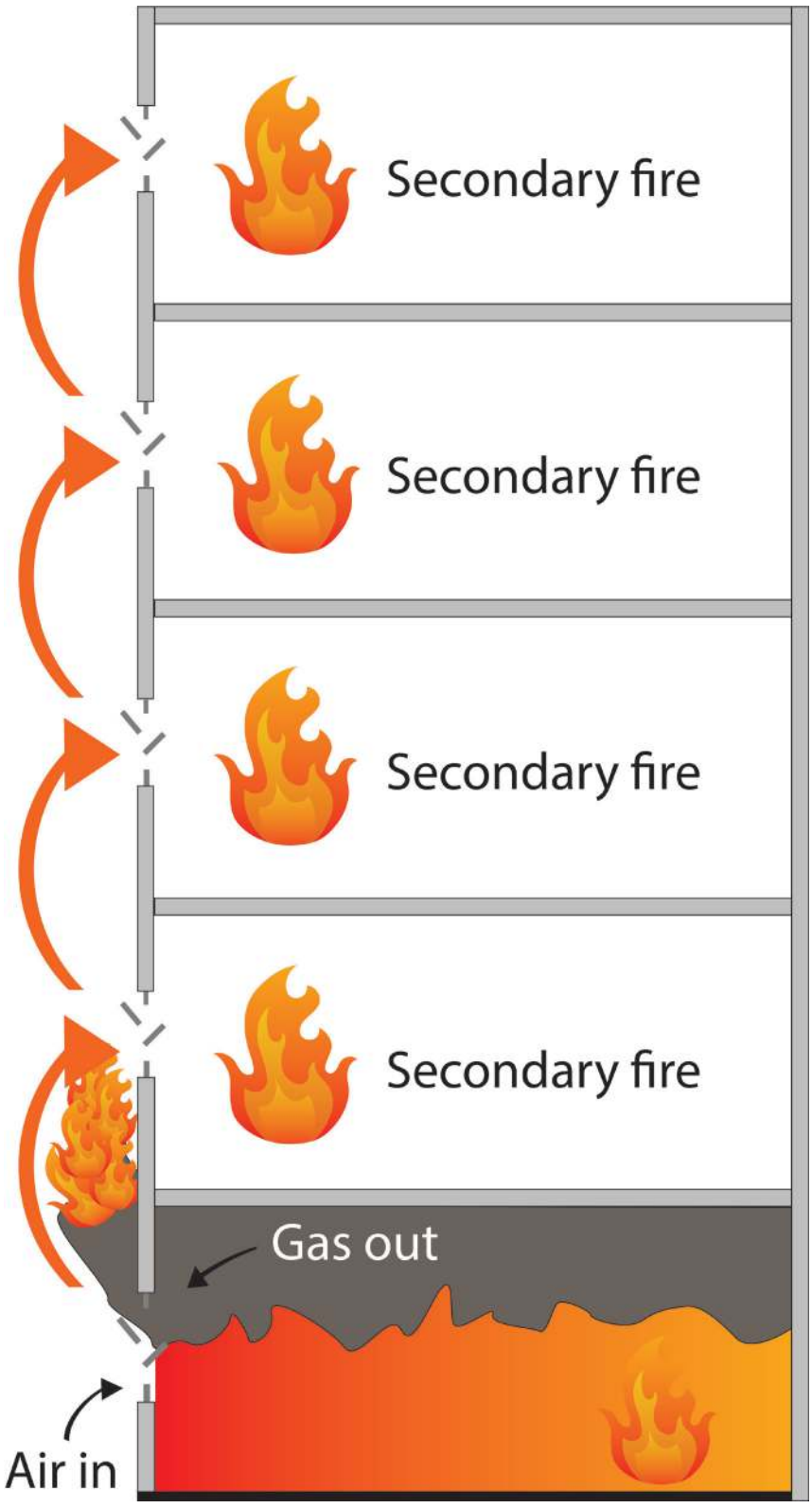
Fire resistance is an integral part of the building envelope.

Fires can spread through buildings even without the involvement of the cladding system materials. There are numerous examples of fire spread from the room of origin to the space above via vertically adjacent windows.

A flashover in a room may cause fire to break out of a window and the flames and hot gasses escaping through a window opening are sufficient to cause the re-entry of the fire in the room above the storey of fire origin. When this mechanism of fire spread occurs, it has the potential to repeat through the same mechanism to every floor above it. Therefore, this is referred to as the **“Leap-Frog effect”**.

While active life safety systems such as sprinklers focus on containing a fire to its room of origin, active systems do not address fire that spreads in the air gap in ventilated façade systems. In a leap-frog situation, the force of flame and hot gasses exiting a lower window moves up the building and breaks the glass on windows of the level above, bypassing interior sprinkler systems and allowing flames to re-enter the building.

The leap-frog effect



Due to the **"chimney effect"**, fire in the air gap behind cladding can spread very quickly.

As the oxygen in the air gap is utilised, the fire seeks more oxygen and moves rapidly upwards.

Fire spreading only on the outside of cladding is often not that critical, while fire that spreads in the air gap behind the cladding **can travel 5-10 times faster in the same time frame** due to rapid buoyancy of hot air in the air gap, compared to fire on the outside. **Speed up to 8 meters per minute have been measured**.

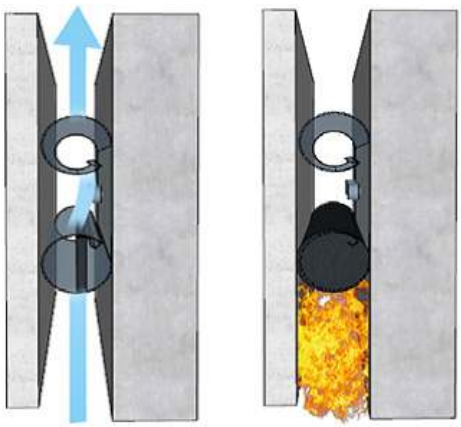
If secondary fire is allowed to develop the process is repeated.

So, in addition to compartmentation within buildings, we also need compartmentation in the façade. This is normally done at floor level and in ventilated façade systems, through the use of ventilating cavity barriers.

Cavity barriers are intumescent based products that are used for sealing cavities and voids in buildings. They are meant to stop or delay the movement of fire through the air gap in ventilated façades and stop the spread to another compartment of the building.

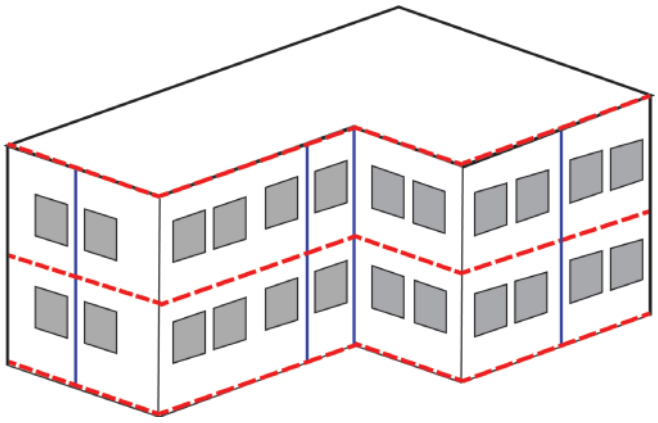
In a fire, a correctly installed cavity barrier will swell and completely close off the gap or cavity and block further spread of fire in the construction.

Correct use of cavity barriers should restrict fire in the air gap so that the only fire strain is from the outside, instead of both sides of the cladding. This will keep the temperature and the fire load on the facade much lower, and greatly reduce the risk of fire spreading to the next compartment.



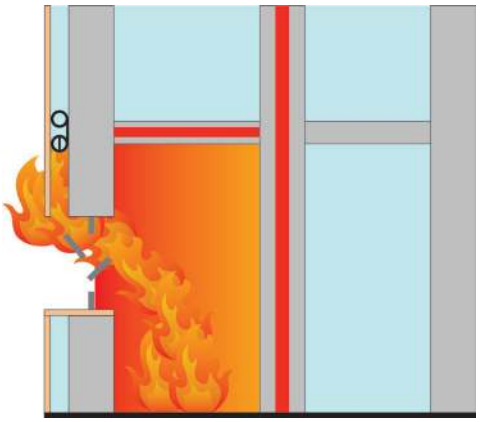
Just like fire compartments inside a building, **cavity fire compartments** prevent fire from entering or spreading to others.

Cavity compartments are designed to limit the extent of hidden fire in a façade to an area where fire can self-extinguish, or firemen can easily access it by external attack through cladding panels, or by penetrating the insulating wall from the inside in high-rise structures.



Ventilated cavity barriers

Solid fire stop



Cavity barriers prevent fire from entering the cavity of rainscreens and from bypassing fire separating elements like floors.

The use of horizontal cavity barriers installed at each floor level will prevent fire from spreading from the place of origin to storeys above.

A cavity barrier should not let flames pass at any time and withstanding direct flame impingement is really important when we consider the chimney effect and the speed at which a fire can spread in an air gap.

When considering that fire can spread up to 8 meters per minute in the air gap behind cladding and that other intumescent based cavity barriers can take up to several minutes to close, the fire can spread far from its origin before the cavity is closed for further spreading.

As fires escalate at great speed, such as observed at Grenfell, there is no time for the intumescent material to expand and seal. If the combustible decor cladding at the Grenfell Tower had been changed to a non-combustible type, it still might not have prevented the furious upward spread of the fire.

The Firebreather cavity barrier is the only cavity barrier in the market with instant fire stop. While all other products need up to several minutes to expand and close of the cavity, the Firebreather product will keep flames from entering the protected area at any time.

The mesh will also stop burning droplets from spreading downward fires and prevent disintegration of the expanded intumescent during fire

The Firebreather™ technology is a patented concept for the development of passive ventilation grilles and cavity barriers with the unique feature of blocking the spread of flames, heat and embers instantly in case of fire.

BUT WHAT IF WE ONLY USE NON-COMBUSTIBLE MATERIALS?

Even if the cavity itself is fully non-combustible, the extended length of flames created in the cavity still allows the flames to reach the next floor level, where windows and other wall penetrations will allow the fire to re-enter the building and maintain the spread of fire.

Therefore, the use of cavity barriers able to withstand direct flame impingement can be crucial to stop the fire from spreading, also in façades with only non-combustible materials .

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