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Student 2: Failure Analysis

Common Problems

(i) Coating Peeling

Non-stick frying pans having PTFE (Teflon) coating are prone to various problems that affect their performance and durability. One of the major problem is coating peeling, which refers to shedding, scaling, or fall-down of the coating layer [1]. The non-stick coating may start to degrade and eventually start peeling-off due to continued use, particularly when the pan is subjected to high temperatures or when it is not used properly, e.g., when it is used with metallic utensils. Coating peeling does not only impact the non-stick properties, it is also poses dangerous health risks when ingested [1].



Figure 1: Peeling of the non-stick coating layer of the pan

(ii) Scratches

The other problem is scratches, which refers to surface damage that occurs when abrasive materials, such as sharp metallic utensils like forks and spoons, or rough cleaning pads scrub the surface of the pan [2]. Scratches weaken and destroy the non-stick layer, making the pan vulnerable to food sticks and more difficult to clean.



Figure 2: Scratches due to use of abrasive materials

(iii) Heat Damage

Another significant problem is heat damage, where too much heat can lead to breakdown of the non-stick coating as well as warping of the material used to make the pan [2]. Also, besides structural or functional damage, prolonged overheating, particularly with temperatures above 260°C can lead to emission of dangerous fumes, and consequently reduce the lifespan of the pan.



Figure 3: A pan damaged by excessive heating

(iv) Corrosion

Corrosion, occurring in the form of rusting or deterioration of metal components, is also a common problem that frequently affects the stainless steel handle of the pan or sections of the base that are exposed to moisture or acidic food [1], [3]. Although PTFE is not susceptible to

corrosion, some metal components of the pan can start to rust or corrode in harsh environments, which creates problems with the pan durability.



Figure 4: A corroded pan with rust

Reasons for these problems

Improper use or inadequate maintenance of the pan leads to these problems. The peeling of the coating occurs when the pan is exposed to high temperatures, and especially when oil is used, which may get hot within a short time. Although the coating, which is made of PTFE, is heat-resistant, it can only withstand heat up to a specific temperature before starting to break-down.

Scratches on the other hand are caused by the user, particularly when they use sharp metal utensils or rough scrubbing tools that unintentionally remove the protective coating [2]. Scratches damage the non-stick coating and makes it less effective.

Heat damage is caused by heating the pan to temperatures higher than the recommended, or when the pan is left empty on a hot burner for too long, making the coating wear away.

Corrosion, although less frequent to non-stick surfaces, occurs when the pan is exposed to moisture and acidic foods over an extended periods of time, resulting in rusting of the metal parts, particularly when the pan is not dried or stored properly after washing [3].

Bibliography

[1] A. Young, "These Are the 3 Main Reasons to Replace Cookware ASAP," *Food & Wine*, 2026. <https://www.foodandwine.com/toxicologist-reasons-to-replace-cookware-amazon-11958504> (accessed Apr. 25, 2026).

[2] Pots and Pans, “Why Does My Non-Stick Pan Scratch and How to Prevent It? - PotsandPans India,” *PotsandPans India*, Mar. 25, 2026.

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[3] American Pan, “5 Reasons Your Bakery’s Pans Don’t Last as Long as They Should,” *American Pan*, May 06, 2024. <https://www.americanpan.com/na/5-reasons-your-bakerys-pans-dont-last-as-long-as-they-should/> (accessed Apr. 25, 2026).

Slides

Slide 3: Problems

- Coating peeling: This refers to shedding, scaling, or fall-down of the coating layer, particularly when the pan is subjected to high temperatures or not handled properly [1].
- Scratches: Scratches refer to the surface damage typically caused by sharp metal utensils or abrasive cleaning tools that cause damage to the non-stick surface [2].
- Heat damage: This refers to the structural or functional damage that takes place when the pan is subjected to high temperatures or overheated.
- Corrosion: This refers to the rusting or deterioration of metal components of the pan, and is usually caused by moisture or acidic contact [3].

Slide 4: Causes

- Coating peeling: Occurs due to overheating or use of inappropriate utensils during cleaning.
- Scratches: Results from using sharp metallic objects when cooking, or using abrasive sponges when cleaning the pan.
- Heat damage: Occurs due to overheating, particularly when left empty for too long on a hot burner [2].
- Corrosion: Occurs due to prolonged contact with moisture and acidic foods that damage the metal parts.

Bibliography

[1] A. Young, "These Are the 3 Main Reasons to Replace Cookware ASAP," *Food & Wine*, 2026. <https://www.foodandwine.com/toxicologist-reasons-to-replace-cookware-amazon-11958504> (accessed Apr. 25, 2026).

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