Infrared inspection of WW2 camouflage German helmets

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Abstract

The German steel helmet is an icon of the last world war and it is highly appreciated by militaria collectors. From the period between the first and the second World War to August 1943, decals referring to the service branch were applied to the German helmets. In order to minimize their visibility the soldiers often covered the helmets with a camouflage paint, sometimes mixed to sawdust and sand.

Infrared pulsed thermography was used on different kinds of camouflage German steel helmets of the Second World War, to detect the presence of decals.

In most of the cases only the shape of the decal clearly appeared in the IR images. In some cases the paint surprisingly resulted to be transparent in the infrared radiation waveband from 3 to 5 μm used by the IR camera, thus allowing to see the drawing inside the decal.

Navy helmets were produced in fewer numbers and they are therefore more desirable for collectors. Navy and Army decals had the same external shape and the same internal drawing of an eagle on a swastika. They only differed for the color and the thickness of the eagle and the swastika due to a particular multilayer production process used for Navy decals. This work also describes a procedure capable of distinguishing Navy from Army decals, even when covered by the camo paint.

Keywords: German helmet decal, camouflage, infrared thermography, Second World War, militaria.

Fig. 1 Second pattern LW eagle.

Fig. 2 Heer eagle.

Fig. 3 KM eagle with stepped rim.

Introduction

The German steel helmet was introduced in 1916 during the First World War, to limit wounds due to new weapons, in particular to grenade splinters. No decals were applied to the helmets during the First World War. Decals started to be applied to the helmets during the period between the two wars.

In 1935 a new steel helmet was introduced (Stahlhelm 35 or M35), reducing some of the disadvantages of the helmets used in the First World War. Before the beginning of the Second World War, Airforce (Luftwaffe - LW), Army (Heer) and Navy (Kriegsmarine - KM) helmets typically had one shield shaped decal on the right, with the three-color of the national flag, and one decal on the left, referring to the service branch. For the Luftwaffe, the service decal had the shape of an eagle grabbing a swastika. Two kinds of eagle existed: a first pattern eagle, which firstly appeared in 1936 and was used till 1939-1940, and a second pattern eagle (Fig. 1), which firstly appeared in 1937 and was used till 1943.

Army and Navy helmets had a similar shield shaped decal, with an eagle on a swastika (Fig. 2 and 3). The only difference was that, for the Navy, the eagle and the swastika had a golden color and, in the first years of production, also a layered structure, producing a step all around them, visible in Fig. 3.

In 1940, the construction of the helmet was simplified with the M40 model and the well visible national colour decal was eliminated from Army, Navy and Luftwaffe helmets. In August 1942, to save time in the production process, the helmet construction was further simplified, creating the M42 model. Starting from 28 August 1943 decals were eliminated from all helmets.

To limit helmets visibility, camo textiles covers started to be used, or more frequently they were painted with different kinds of paint, often mixed to sawdust and sand to make the surface more rough and less reflecting. Of course, colours could change according to the environment, from white for the snow to yellow for the desert.

The description of the German helmets and decals given above, is of course not exhaustive and more information on the different helmets, the five different manufacturers (ET, SE, Q, EF, NS) and the different decals

Fig. 4 M40 SE66 shipboard grey (Courtesy J. M. Meland).

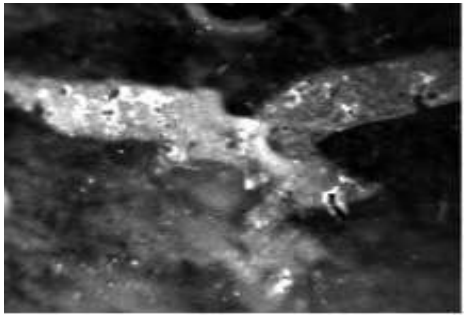

Fig. 5 Image of a second pattern LW eagle obtained by pulsed thermography.

used during the war, can be found in specialized books as «K. Niewiarowicz», « K. Niewiarowicz and A. Lehrman » or «J. M. Meland».

Collecting militaria

When at the beginning of 1900 industry and technology started to shape the world as we know it, weapons became more and more precise, and destructive. In the second world war entire towns were destroyed, countries were devastated, millions of people died, the entire world was shaken.

Today, a helmet, a witness and a symbol of all this, arrives somehow into our hands. A German helmet, with its distinctive shape designed to protect the soldier, is, probably more than anything else, an icon of the last world war and, for what it represents, it can arouse strong emotions in those understanding what the last world conflict has been and desiring to preserve its memory. Collectors of militaria are among those people and they are eager to know as much as possible about the items in their collection.

The value of an helmet depends very much on the grade of preservation and on the rarity of the object itself.

The number of Navy helmets was significantly less than for other branches and the layered structure often resulted in a more fragile decal. Navy helmets are, therefore, among the most valuable pieces.

Thermographic inspection

Infrared pulsed thermography («W.N. Reynolds») was used to inspect camo helmets and reveal possible decals hidden beneath the camo paint surface. The camera used for the experiments was a FLIR-Cedip Titanum with an IR Focal Pane Array sensor InSb 320x256 working between 3 to 5 μm and with a NETD of 20 mK at 30°C.

A flash lamp Elinchrom Style RX 1200 was used as a heat source. A filter was placed in front of the lamp, cutting its infrared emission, in order to avoid reflections from the lamp itself.

M40 SE66 shipboard grey

KM helmets were often camouflaged using the same paint used on the ships. Fig. 4 shows a M40 SE66 lot number 4938, painted on its surface with a typical shipboard grey colour. This helmet was found in Norway, and from the colour of the camouflage it was presumed to be KM. Fig. 5 shows, however, that behind the camo paint there is a second pattern LW eagle.

Fig. 6 DAK camo M35 ET64 helmet

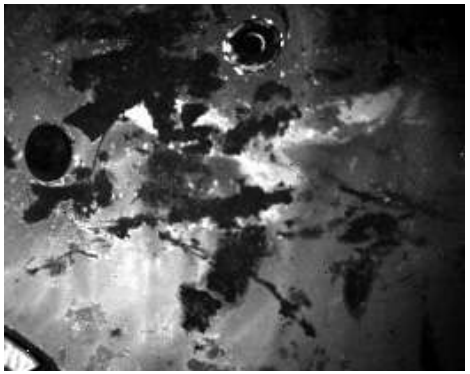

Fig. 7 LW eagle with some damages extending to the original paint too.

M35 ET64 DAK

Deutsches Afrikakorps (DAK) helmets are rare because it is estimated that only one percent of the German forces were employed in Africa. Fig. 6 shows an helmet with a sprayed desert camouflage. The chinstrap is marked LBA (*Luftwaffe Beschaffung Amt*) and dated 1937. On the left side IR thermography showed a second pattern LW eagle (Fig. 7) and some damages on the original paint and on the decal, indicating that the helmet had long been in use before the camouflage process.

On the right side the national three-color shield was found, also severely damaged.

M35 ET64 with woodchip camo

The helmet of Fig. 8 is an M35 ET64. It was found in Sjoa (Norway). It was spray painted with added woodchips, in order to obtain a rougher and less reflecting surface. The internal original color is green, thus indicating a Heer or a KM. Woodchip can completely hide the decal in an IR pulsed thermography inspection. Fig. 9 shows the decal shape, but it is impossible to say if the decal is a Heer or a KM.

M40 ET64 with concrete camo

The helmet of Fig. 10 was found in Norway and it is covered by concrete painted in various tones of green and brown. Due to its vivid colors and the good condition of the surface, there were doubts about it authenticity. Similar helmets were found in Norway. The majority of collectors considered these helmets to be original, explaining that the good condition of the surface could be due to the fact that the helmets had been kept in a depository after the camouflage process.

IR thermography revealed a second pattern LW eagle appearing in between the concrete patches (Fig. 11), thus giving a further indication in favor of its authenticity.

M35 ET62 shipboard grey

The helmet of Fig. 12 was found in a coastal area of Norway and it has the typical shipboard grey camo used in many KM helmets. Surprisingly, its camo paint was transparent to the IR radiation in the 3 – 5 μm waveband used by the IR camera. This allowed to see the eagle and the swastika inside the decal (Fig. 13).

Fig. 8 M35 ET64 woodchip camo (courtesy J.M. Meland).

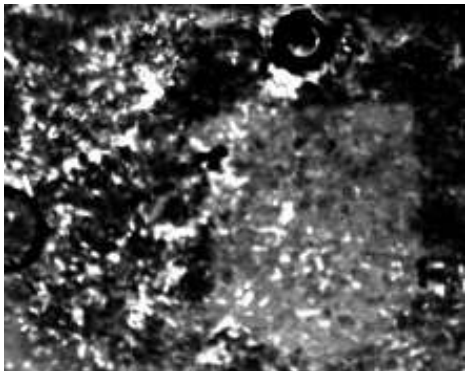

Fig. 9 Decal appearing on the left side.

Fig. 10 M40 ET64 covered by concrete patches and painted in green and brown (courtesy J.M. Meland).

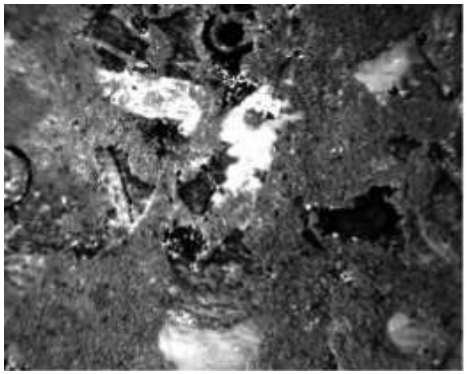

Fig. 11 Second pattern eagle appearing among the concrete patches.

Apart from the colour of the camo paint, there was no proof that the helmet was a real KM.

The golden colour of the decal did not appeared on the surface in any point and of course could not be seen in the infrared image. Several attempts were made acquiring a sequence of IR images after an heating pulse in order to obtain the equivalent of a phase image in pulsed phase thermography («X. Maldague, S. Marinetti »), in

Fig. 12 M35 ET62 shipboard grey.

Fig. 13 Camo paint transparent in the 3-5 μm waveband.

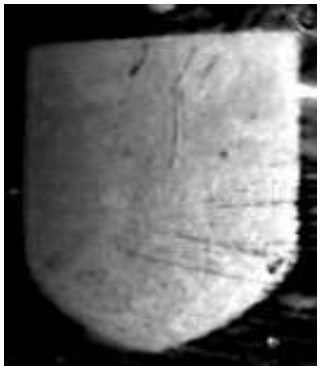

Fig. 14 Contour of the eagle and the swastika obtained in the 8-14 μm waveband.

the attempt to reveal the different local thickness of the eagle and the swastika. None of these attempts was successful, because in this case the visible light and the IR radiation were absorbed and emitted on different layers.

Pulsed thermography was then performed on this helmet using a FLIR Jade II IR camera, with a HgCdTe sensor, working in the 8-14 μm waveband, in which the camo paint was not transparent. Fig. 14 shows the result obtained. The shape of the eagle and the swastika inside the decal appear clearly as a darker area. This indicates not only that the area with the eagle and the swastika has a different thickness than the rest of the decal, as for a multilayer KM decal, but also that the multilayer structure of KM decals was obtained introducing a more conductive, probably metallic, thin layer as an intermediate layer.

Conclusions

Pulsed thermography proved to be an effective non-destructive procedure to see decals in most of the camo painted helmets. The addition of sand, sawdust and woodchip to the paint, could in principle hide completely a decal also for a thermographic inspection. The local thickness difference between KM and Heer decals could be used to differentiate them when the decal was covered by a sufficiently smooth layer of camo paint.

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