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Makeup Extraction of 3D Representation via Illumination-Aware Image Decomposition (*Supplementary Material*)

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In this supplementary material, we provide more detailed example results of our method. We also present the figures without adjusting the contrast of the specular reconstruction mentioned in the main paper.

The example results are presented from Fig. 1 to Fig. 8. The first rows show the input images and the disentangled coarse materials of reconstructed 3D faces. The second rows show the fully reconstructed 3D faces and the disentangled coarse materials in the UV space. The third rows demonstrate the refined facial materials and extracted bare skin and makeup. The final rows show the fully reconstructed renderings and the overlaid rendering images (from left to right: bare skin only, bare skin plus makeup, bare skin multiplied by diffuse shading, and plus specular reconstruction).

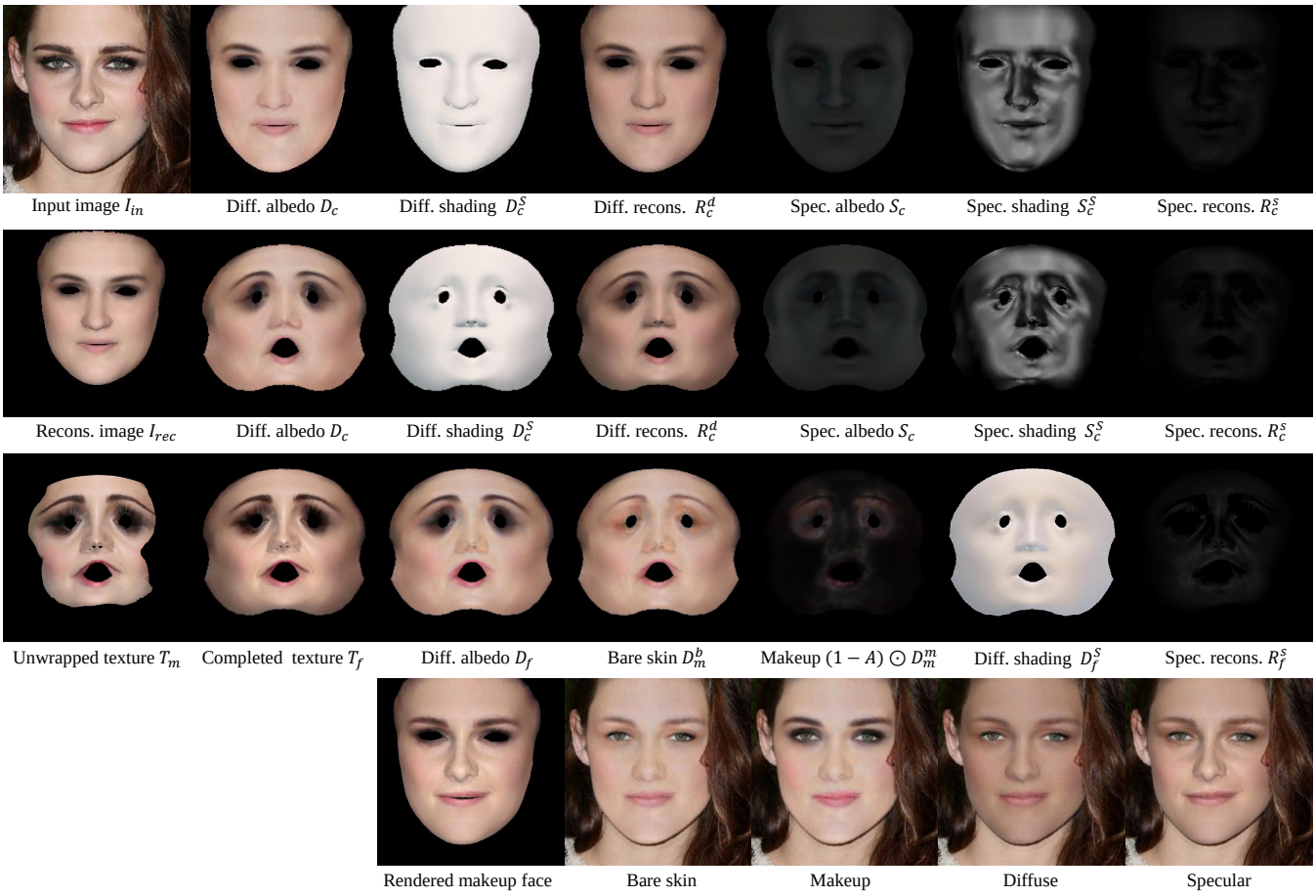


Figure 1: *Outputs for each step and overlaid rendering images.*

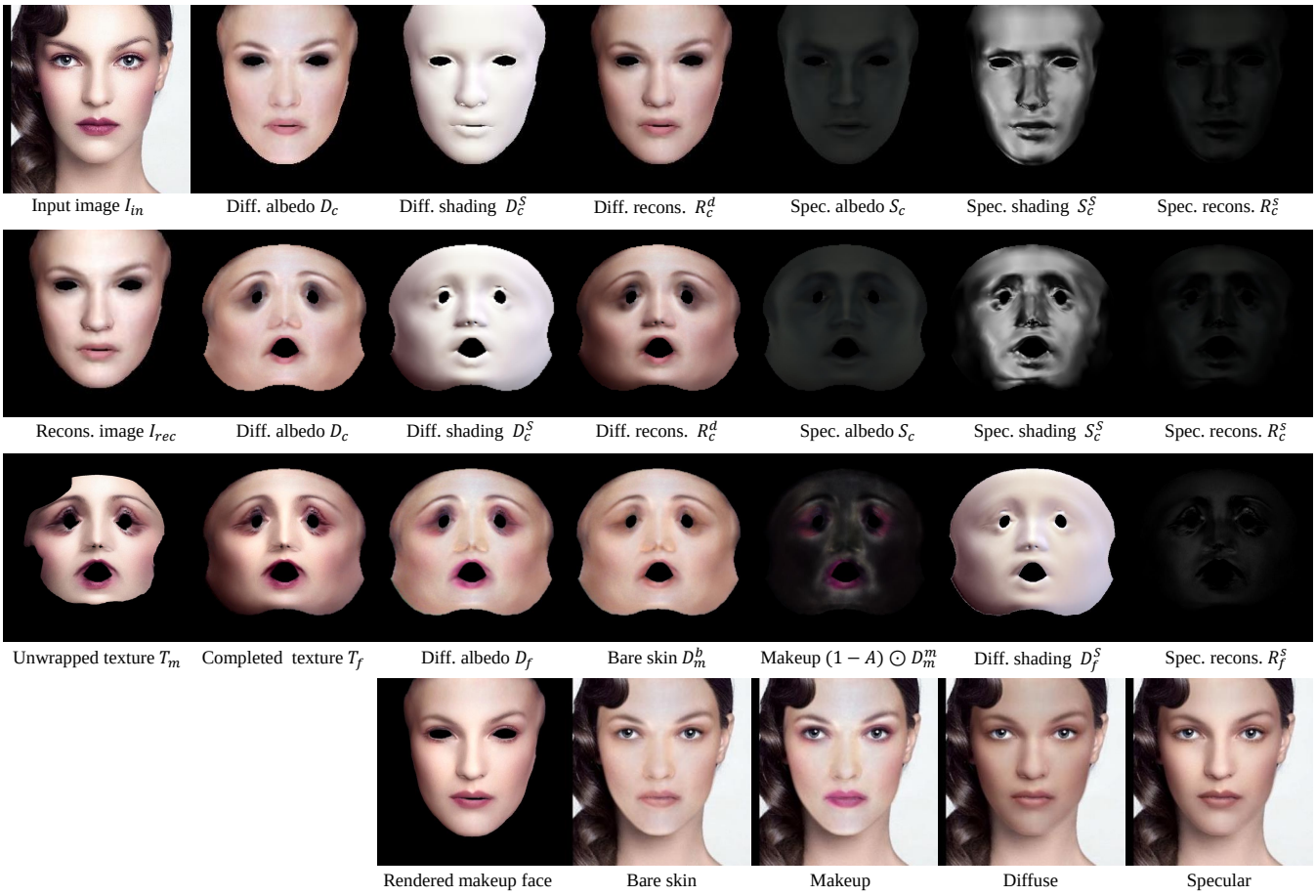


Figure 2: *Outputs for each step and overlaid rendering images.*

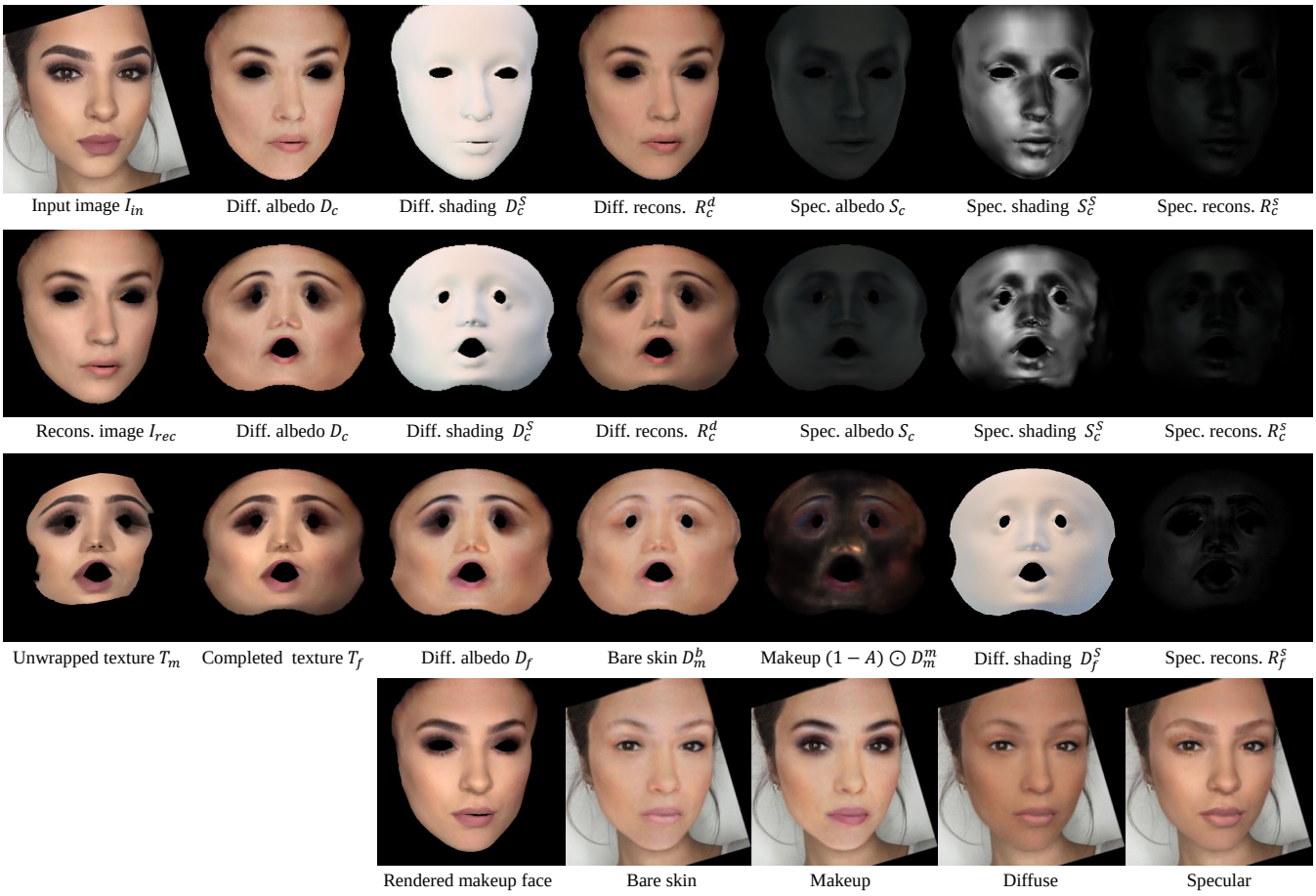


Figure 3: *Outputs for each step and overlaid rendering images.*

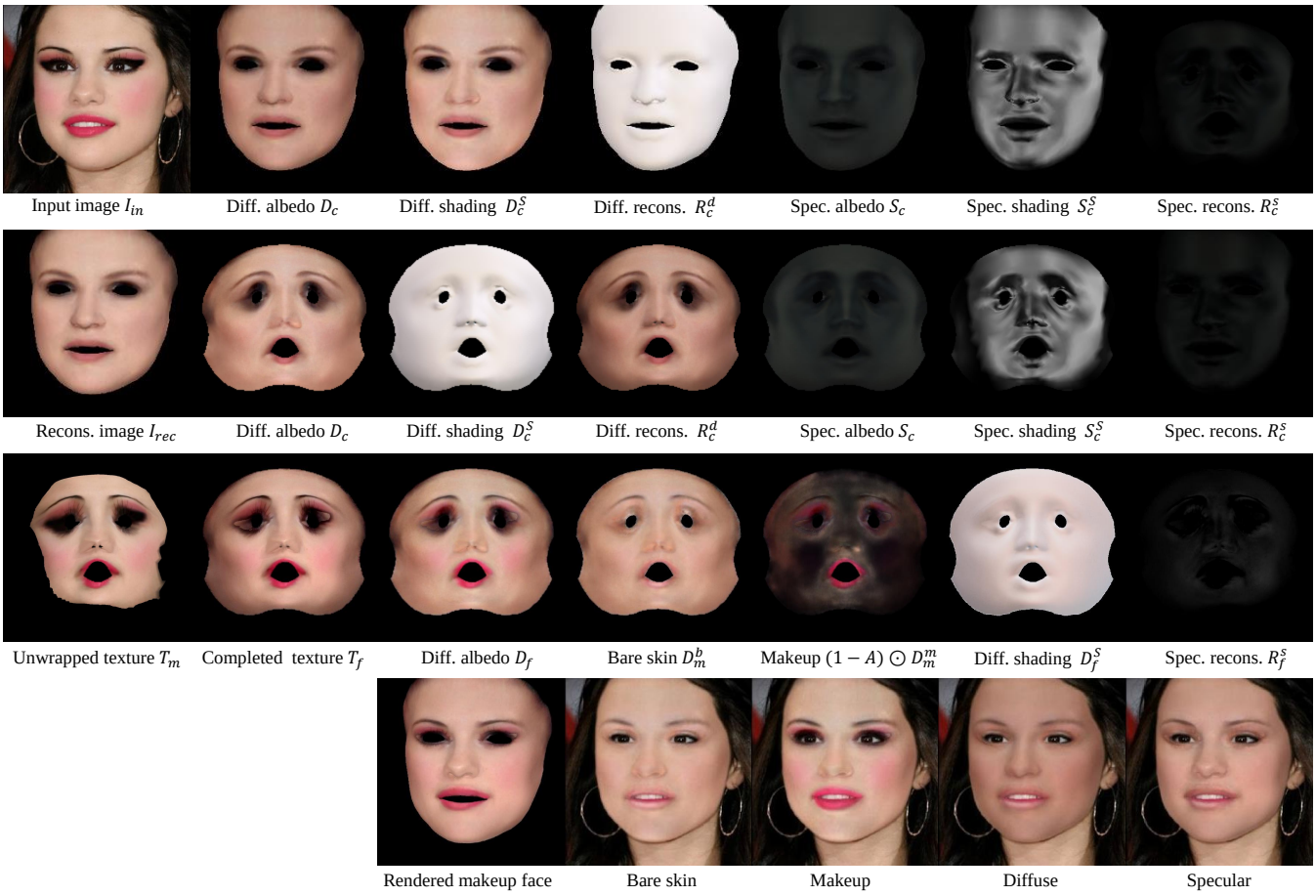


Figure 4: *Outputs for each step and overlaid rendering images.*

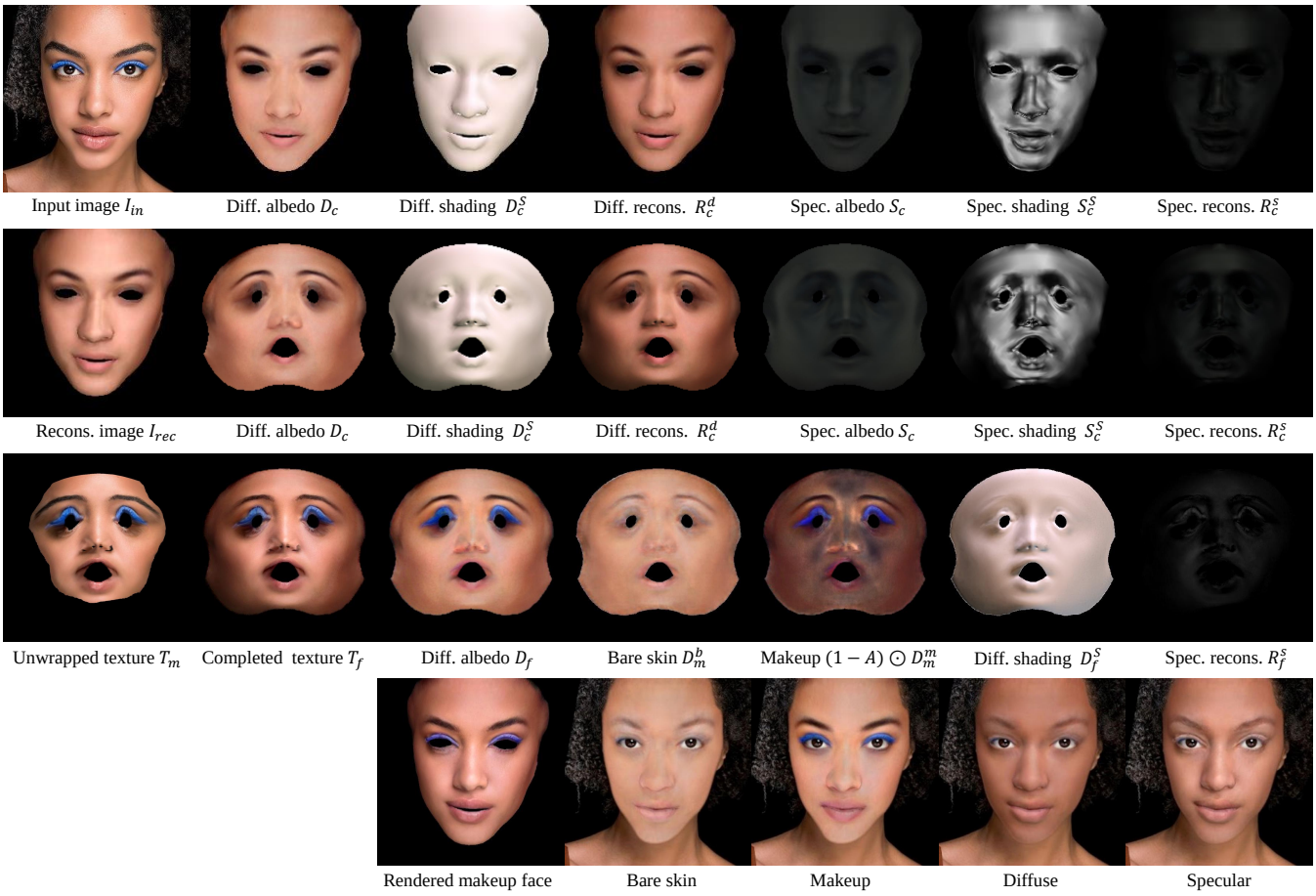


Figure 5: *Outputs for each step and overlaid rendering images.*

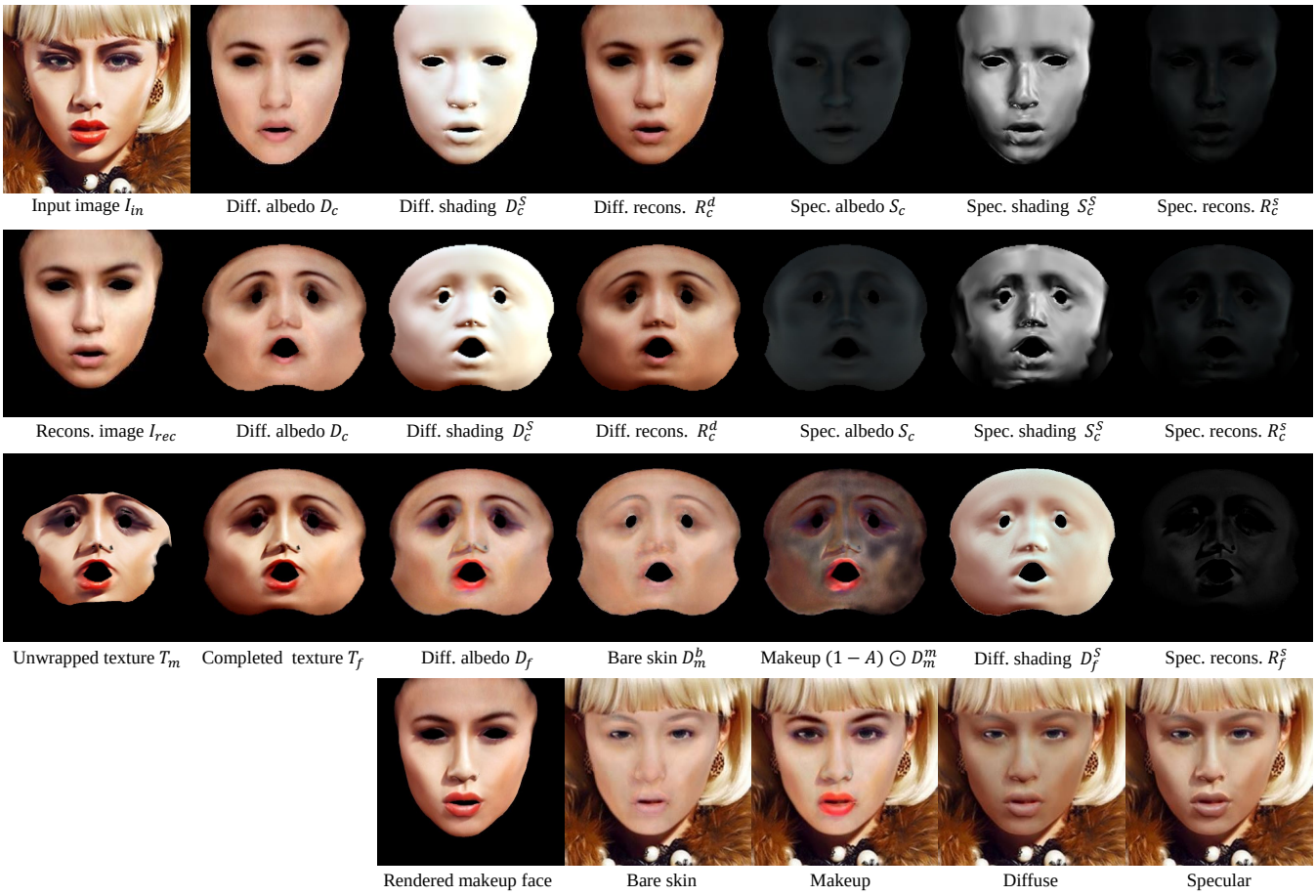


Figure 6: *Outputs for each step and overlaid rendering images.*

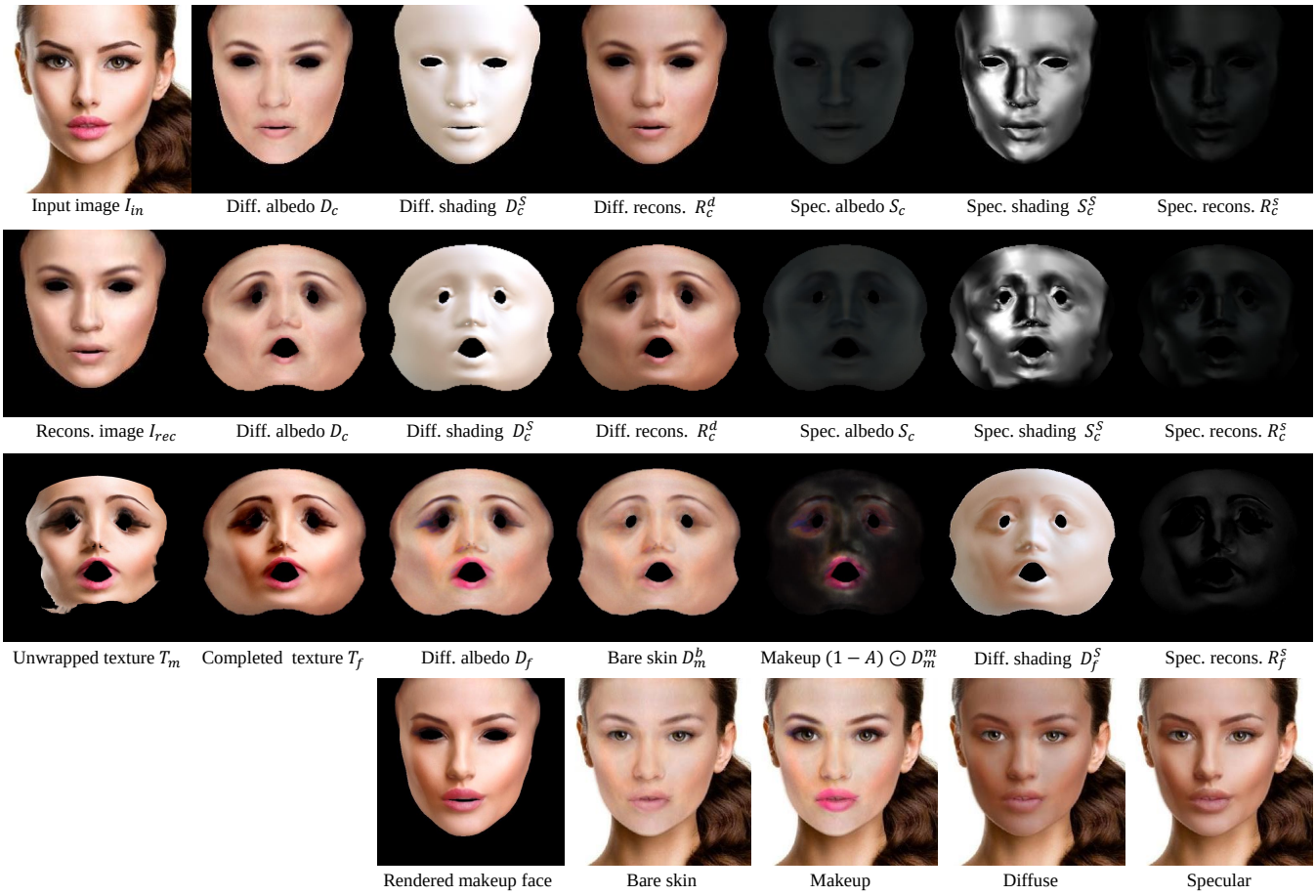


Figure 7: *Outputs for each step and overlaid rendering images.*

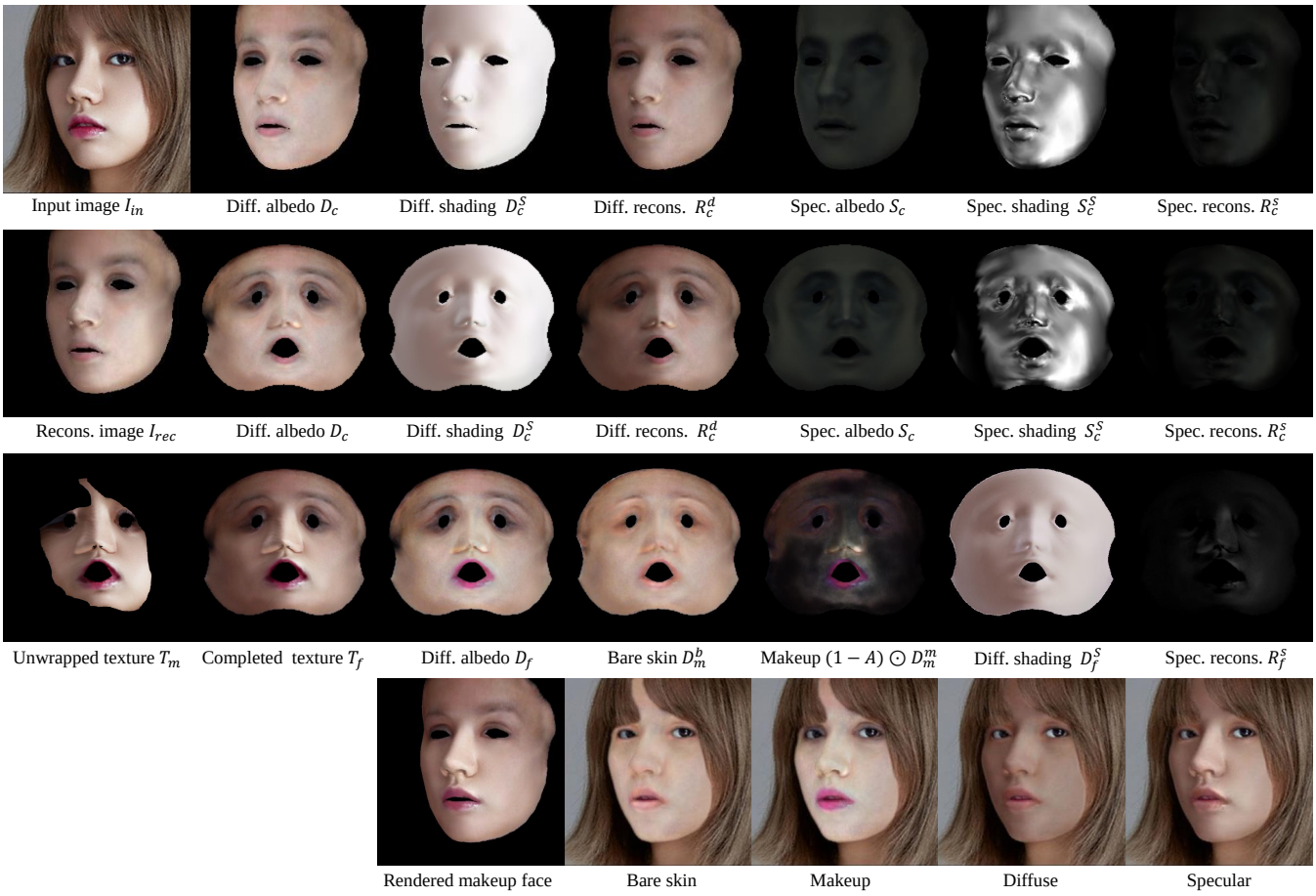


Figure 8: *Outputs for each step and overlaid rendering images*

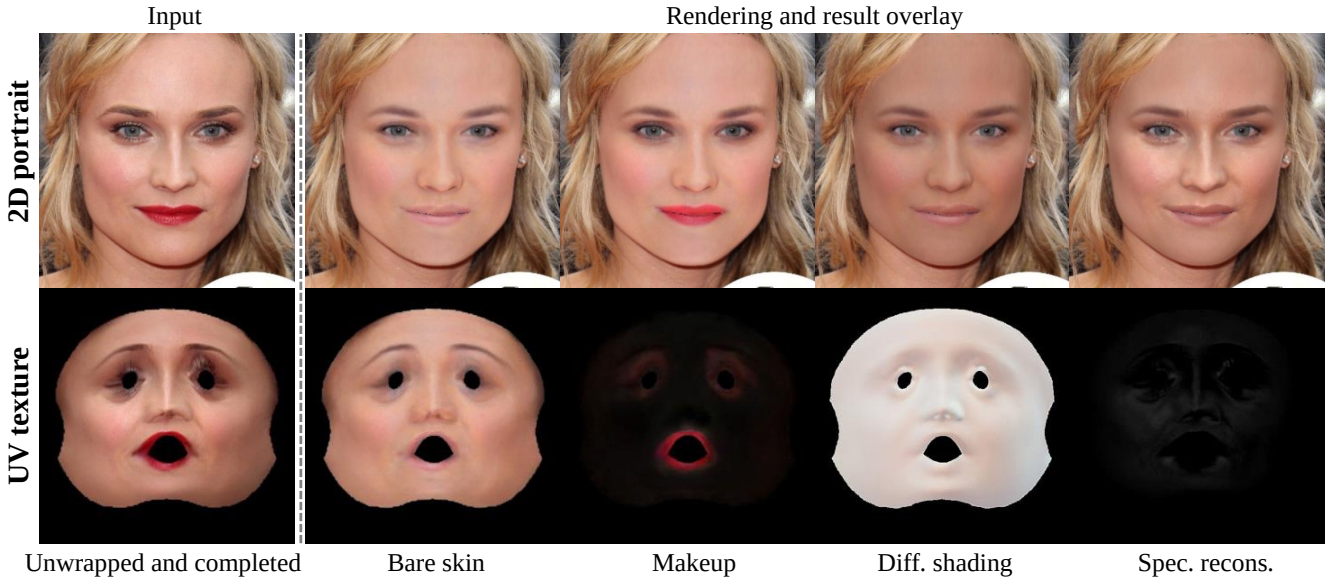


Figure 9: *Makeup-aware facial inverse rendering and component-wise reconstruction. The top row displays a makeup portrait input and overlaid rendering images (from left to right: bare skin only, bare skin plus makeup, bare skin multiplied by diffuse shading, and plus specular reconstruction) whereas the bottom row shows disentangled materials in the UV space*

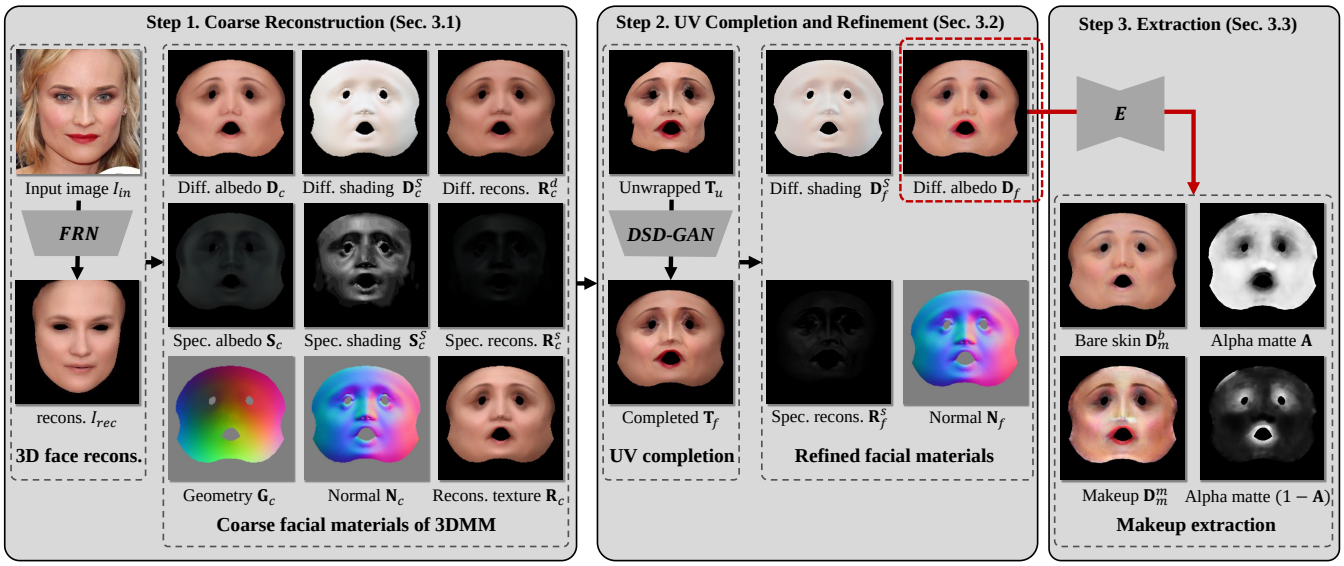


Figure 10: *Overview of our framework. Given a makeup portrait, we extract an illumination-independent bare skin and makeup in the UV space via the following three steps; First, we reconstruct a 3D face to estimate the coarse facial materials using a 3D face reconstruction network FRN. Second, we refine the coarse facial materials, which might have missing pixels due to occlusion. We apply an inpainting network DSD-GAN and then apply optimization. Finally, we extract a bare skin, makeup, and an alpha matte from the refined diffuse albedo using makeup extraction network E.*

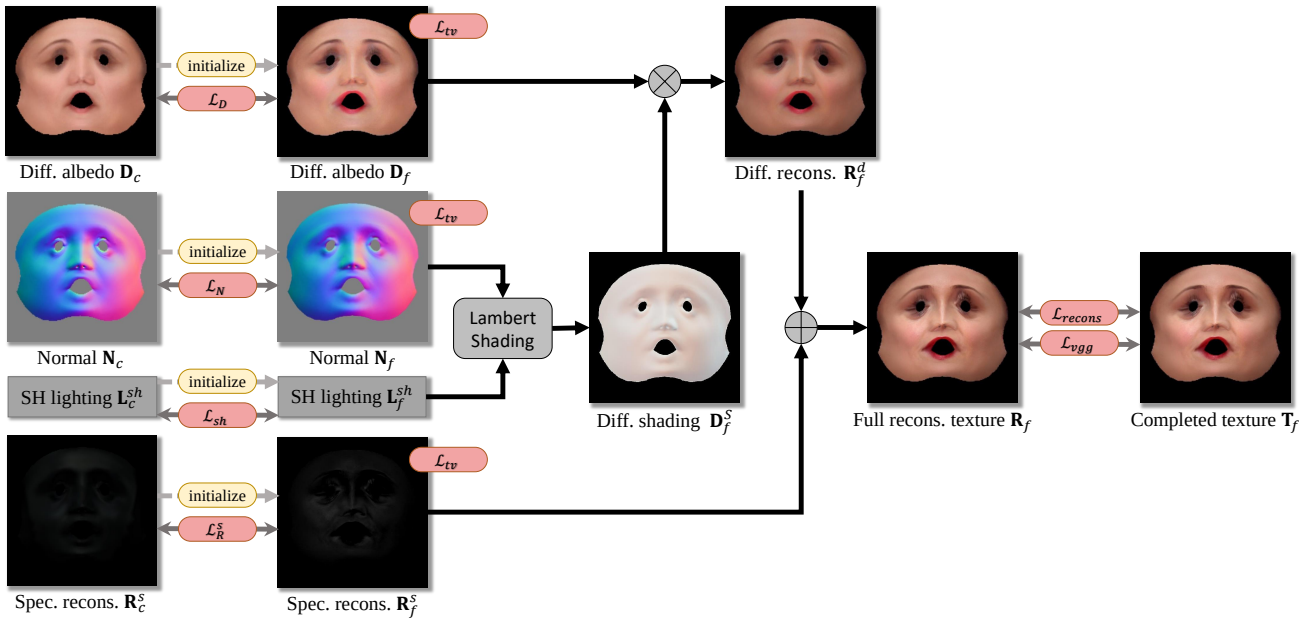
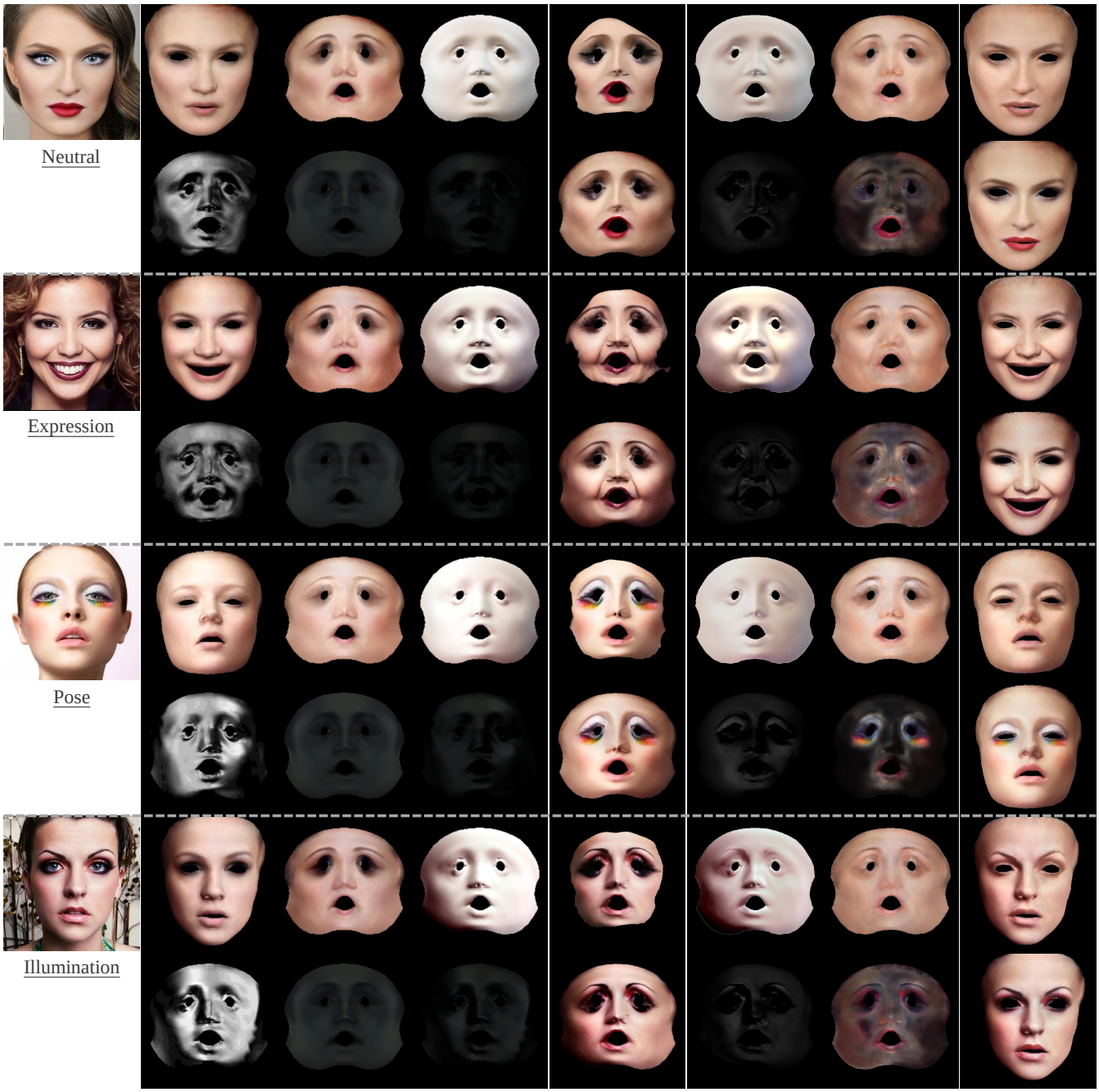


Figure 11: *Facial material optimization module for Step 2 We optimize the coarse facial materials $\{D_c, N_c, R_c^s\}$ and SH lighting L_c^{sh} so that the full reconstruction R_f resembles the completed texture T_f.The refined diffuse albedo D_f, normal N_f, and specular reconstruction R_f^s are the outputs. $\oplus$ and $\otimes$ denote the per-pixel addition and multiplication, respectively.*



(a) Input | (b) facial inverse rendering (3D face recons. result, Diff. albedo, Diff. shading) (Spec. shading, Spec. albedo, Spec. recons.) | (c) Completion | (d) Final output (Diff. shading, Bare skin) (Spec. recons, Makeup) | (e) Recons.

Figure 12: *Intermediate outputs for each step. Left to right and top to bottom: (a) input makeup portraits, (b) facial inverse rendering (diffuse albedo, diffuse shading, specular shading, specular albedo, and specular reconstruction), (c) unwrapped and completed textures, (d) final refined facial materials (diffuse shading, bare skin, specular reconstruction, and makeup), and (e) rendered bare skin face and rendered makeup face using textures from (d).*

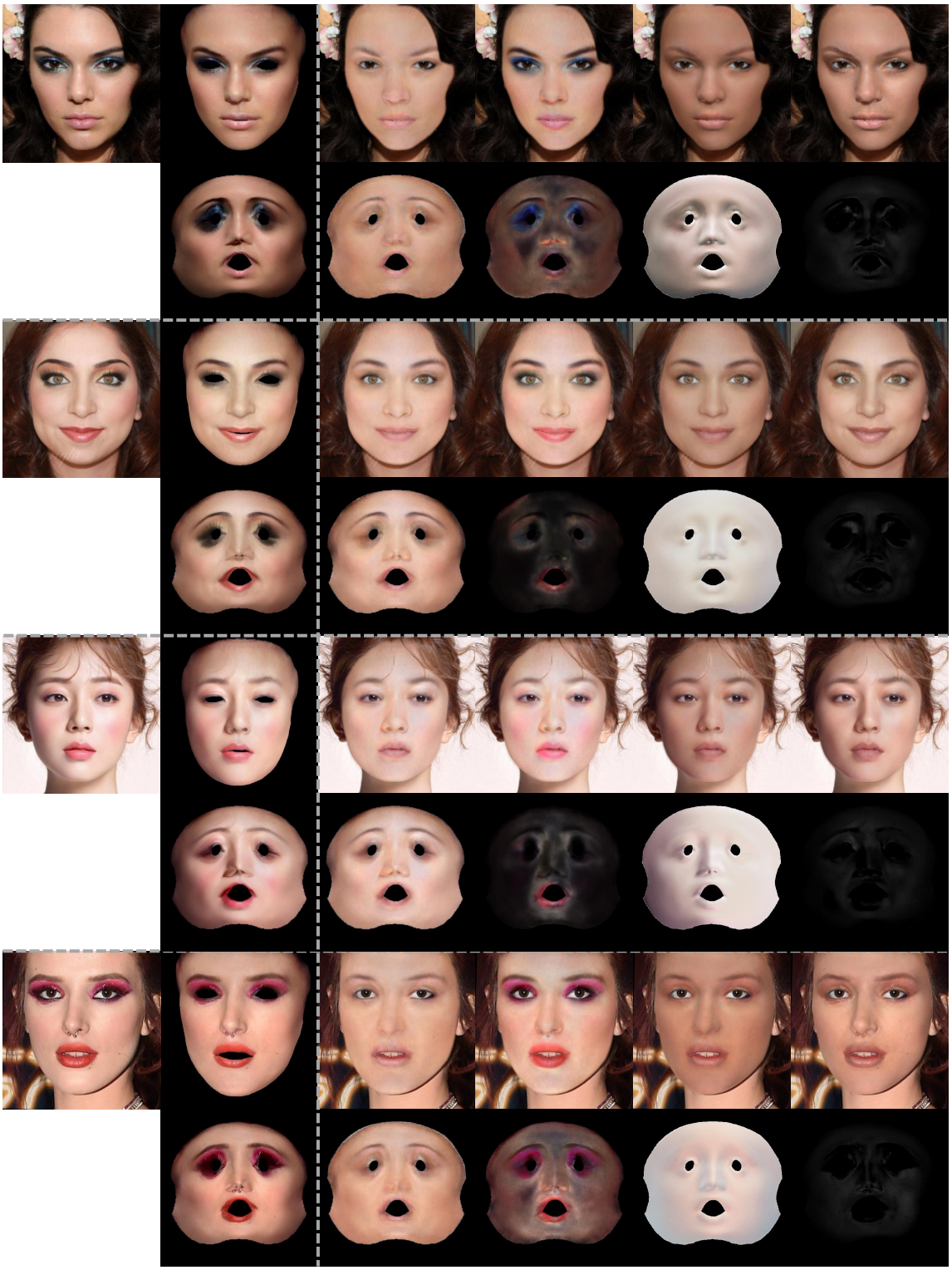
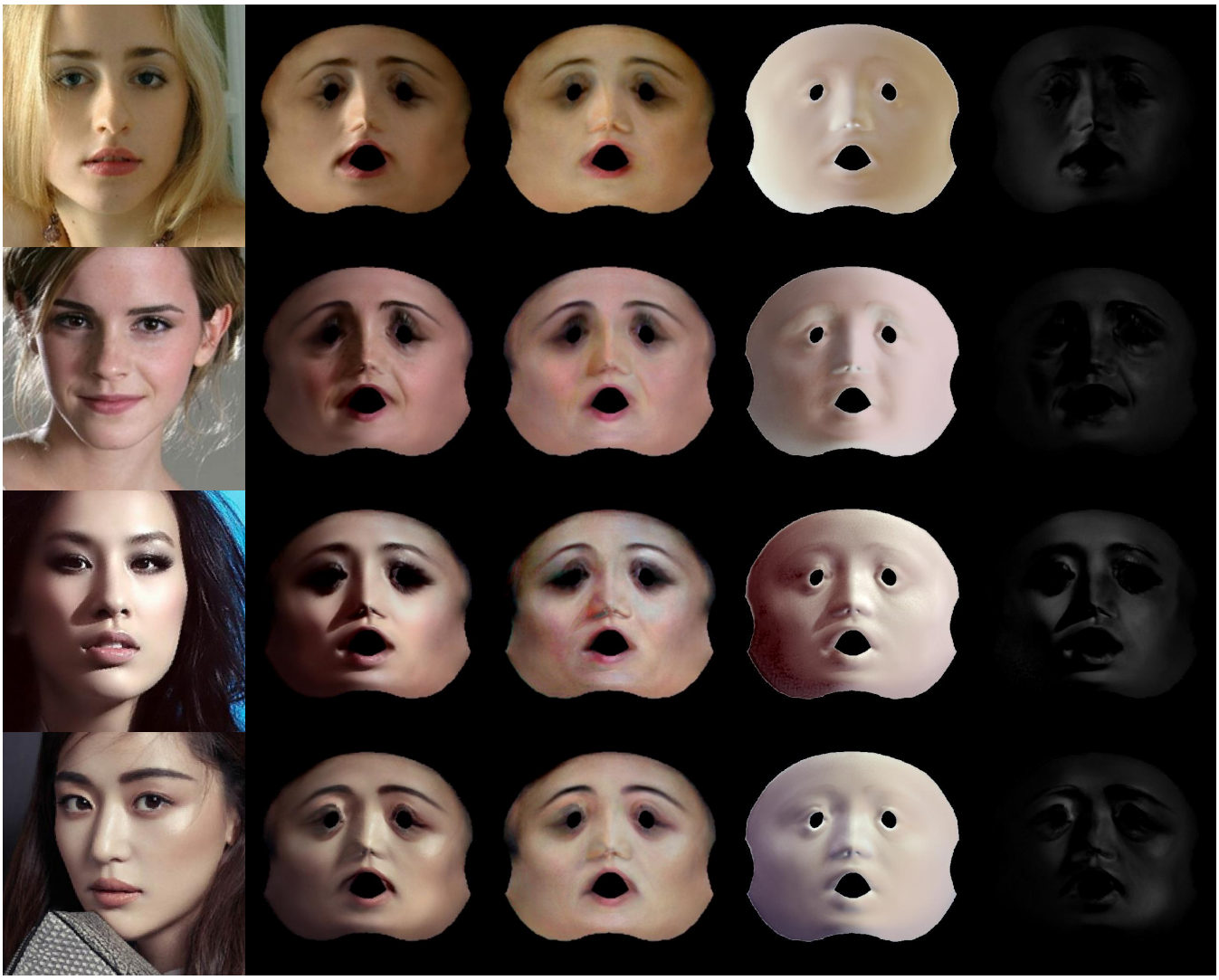
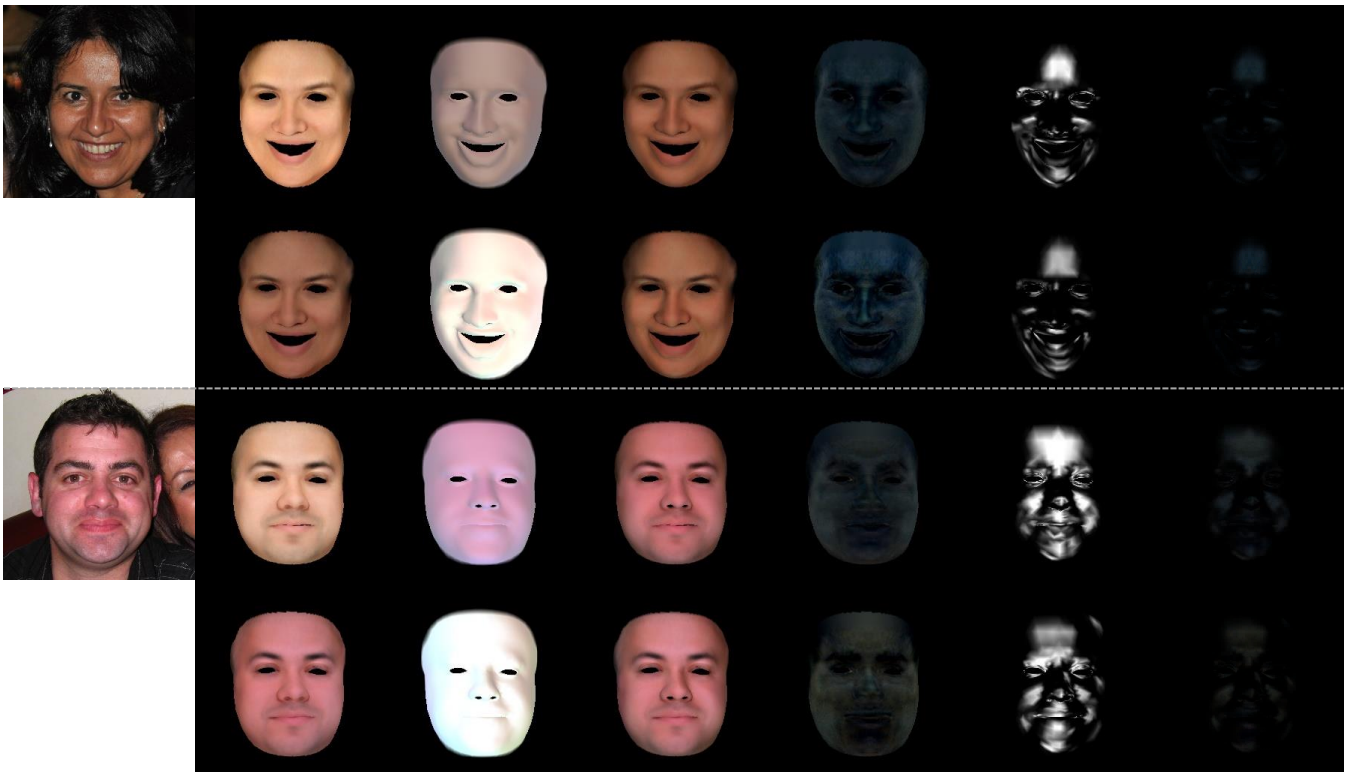


Figure 13: *Final outputs of our framework. (a) Input makeup portraits, and (b) fully reconstructed renderings and corresponding textures. Columns from (c) to (f) are similar to those of Fig. 9.*



(a) Input (b) Completion (c) Diff. albedo (d) Diff. shading (e) Spec. recons.

Figure 14: *Outputs of decomposed refined facial materials in complex illumination conditions. Left to right: (a) input makeup portraits, (b) completed UV textures, (c) diffuse albedo, (d) diffuse shading, and (e) specular reconstruction.*



(a) Input (b) Diff. albedo (c) Diff. shading (d) Diff. recons. (e) Spec. albedo (f) Spec. shading (g) Spec. recons.

Figure 15: *Qualitative ablation study for skin tone adjustment. For each identity, the upper and lower rows display the results before and after the skin tone adjustment, respectively. Left to right: (a) input face images, (b) diffuse albedo, (c) diffuse shading, (d) diffuse reconstruction, (e) specular albedo, (f) specular shading, and (g) specular reconstruction.*